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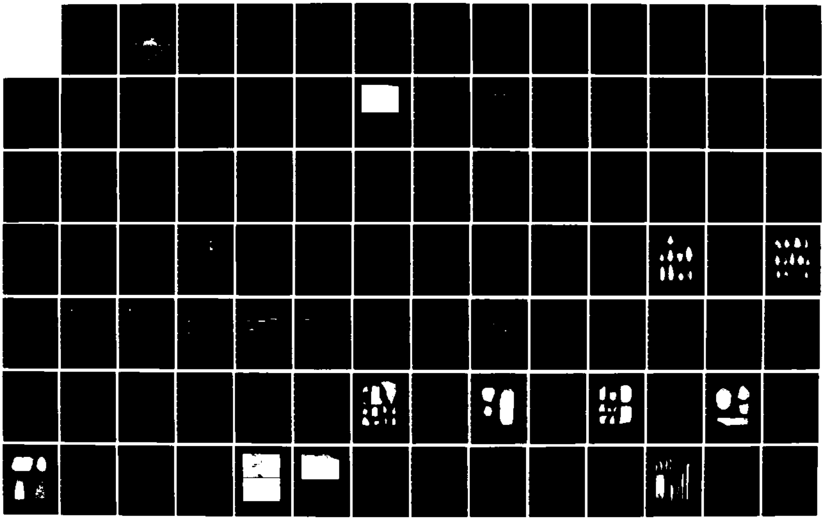

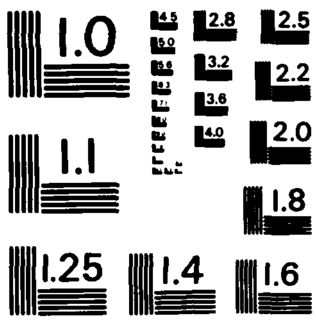

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AD-A147 658

HUMAN ADAPTATION ALONG THE COLUMBIA RIVER 4700 - 1600 BP.

A Report of Test Excavation at River Mile 590, North Central Washington

By James Chatters
With Contributions By
Gregory Cleveland
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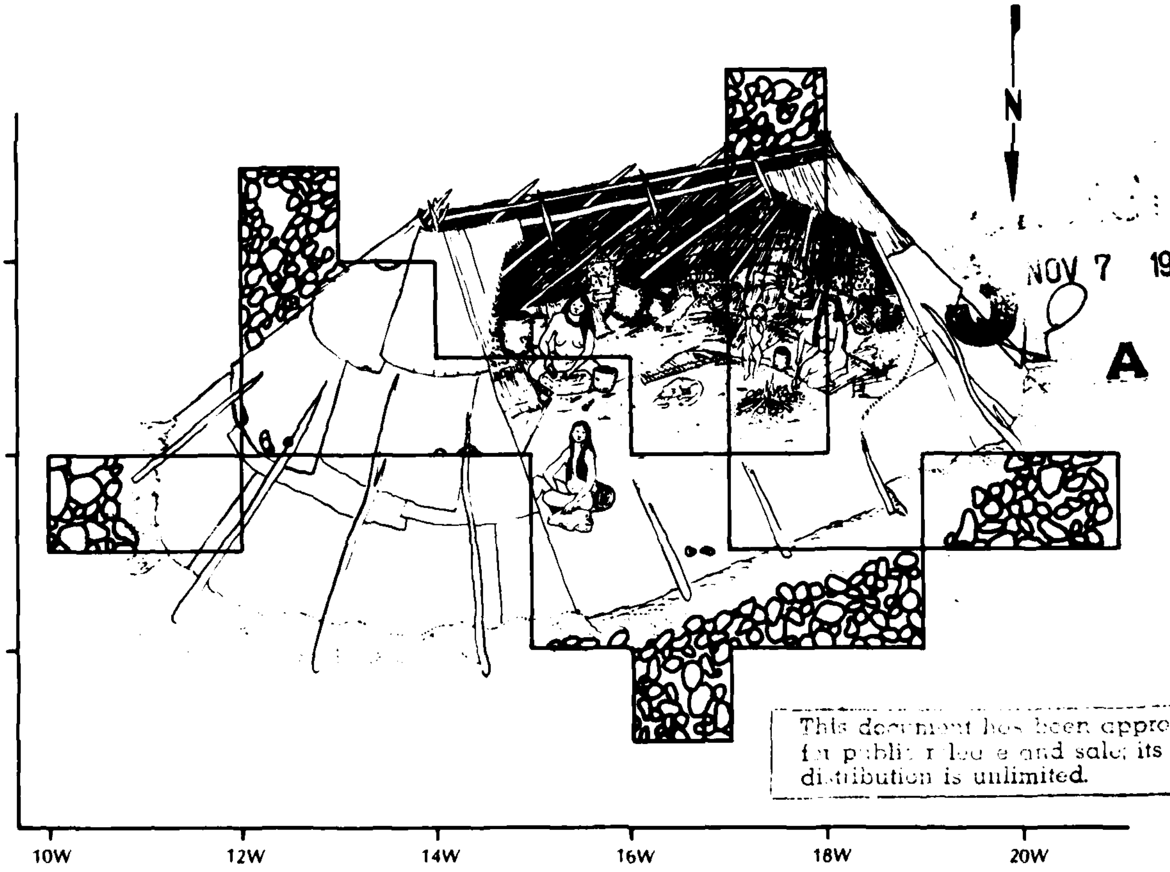

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RESEARCH REPORTS

A Message From Graduate Studies & Research

January, 1984

This issue of RESEARCH REPORTS is part of a continuing and selected series designed to offer the reader some glimpses of the research and scholarly work of the Central Washington University faculty. Research and scholarly activities have been, and continue to be, an integral part of the academic process. Research facilitates the learning process of both faculty and students and enables the University as a whole to improve its quality and value to the public it serves.

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Dale R Comstock

Dale R. Comstock
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DACW67-82-C-0082

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This report was prepared under Contract No. DACW67-82-C-0062 between Central Washington Archaeological Survey, Central Washington University and the Seattle District, U.S. Army Corps of Engineers.

The technical findings and conclusions in this report do not necessarily reflect the views or concurrence of the funding agency.

TEST EXCAVATION AT RM 590
RUFUS WOODS LAKE, NORTH CENTRAL WASHINGTON

Human adaptation Along the Columbia River, 4700-1600 BP

by

James C. Chatters

with

Gregory C. Cleveland and Dianne E. Semko

Central Washington University Occasional Paper, No. 1

This report prepared under Contract No. DACW67-82-C-0062 between Central Washington Archaeological Survey, Central Washington University and the Seattle District, Corps of Engineers.

ABSTRACT

This document reports the techniques and findings of a series of cultural resource test excavations at Columbia River Mile (RM) 590, near Belvedere in Okanogan and Douglas Counties, Washington. Conducted by Central Washington Archaeological Survey under contract with the Seattle District, U.S. Army Corps of engineers, with funding provided by the Corps of Engineers and Boise Bureau of Reclamation, the study entailed test excavation at ~~sites~~ 45DO12M, 45DO189, 45DO190/191, 45DO394, 45OK165, 45OK193, 45OK198, 45OK199, 45OK205, 45OK207, 45OK208 and 45OK219. We present here the procedures used to test sites and analyze resultant data, summarize the results of analyses, and offer an evaluatiou of each site's information potential.

Working from an evolutionary-ecological point of view, we 1) identify and date each occupation zone in each site; 2) identify each occupation to a settlement class based on features, fauna, and lithic-use wear; and 3) offer a tentative reconstruction of settlement patterns for the first four periods of local prehistory (>5000 to 1600 BP). Combining our findings with an environmental reconstruction drawn from local geomorphological data and regional paleontologic, geologic and palynological records, and with archaeological data from elsewhere in the Columbia Plateau, we generate a revised outline of regional prehistory.

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Acknowledgements

Funding for this project was provided by the Seattle District, U.S. Army Corps of Engineers and Boise Region, Bureau of Reclamation. Besides providing funding, these agencies provided equipment, materials, and laboratory space as well as technical assistance. Seattle District archaeologists Lawr Salo, David Munsell and our project liaison Jonathan Maas assisted us in many ways and were especially helpful as a sounding board for our ideas about local prehistory. Jim Budolfson and Terry Zontek of the Bureau of Reclamation were, as always, thoughtful, congenial collaborators in this undertaking.

Our work was the continuation of a major cultural resources mitigation program made possible in part through the genuine interest of the Colville Confederated Tribes (CCT). The diligent efforts of Adeline Fredin, tribal historian, were particularly important in the inception and continuation of the Chief Joseph Dam Cultural Resources Program. A permit from the CCT and permission granted by Barney Owsley, landowner and, now, friend, allowed us access to Okanogan County sites.

We were fortunate in having unusually competent and efficient field and laboratory staffs. Greg Cleveland and Chris Miss served as crew chiefs, Jackie Cook, Carol Ellick, Diana Farrow, John Flettre, Pam Ford, Jim Leavitt, Steve Lipsky, Larry Fredin, Susan Freiberg, Eric Gleason, Marcella McCraigie, Charlene Sam, Kathleen Sam, Rob Stone, Kelly Yates, and Jennifer Yazzie were the excavators. Renee Pepoy did an admirable job of maintaining supplies and records as lab director during fieldwork; Dianne Semko took over this job during the analysis phase. Nancy Cawston, Bill Neuman, Dianna Wilder, Ray Cunna and Kirsten James were their assistants. John Benson helped Cleveland with the lithics analysis.

The production crew for this report included Dr. William C. Smith, Mark and Peggy Bowers, John Benson, Carol Ellick, John Flettre and the diligent Monica Ekiss, CWAS Program Assistant. We could not have produced this report without their help, without the drawings by Marilyn Morrison, Jim Baugh and Dianne Semko, nor the photography by Brian Barry. CWU Production Lab staffers Darwin Davis and Larry Watson put aside their regular work to complete the graphics in a timely manner. The staff of Small Towns Institute proofread the text.

This report has benefited from editorial and content suggestions from Seattle District archaeologists Lawr Salo, David Munsell and Jonathan Maas. Artifact photographs were used in the place of scale pen and ink drawings at their request. Comments by Rob Whitlam (State archaeologist for Washington), Fred Jaehnig (Acting Director, Washington Archaeological Research Center) and several anonymous reviewers were appreciated. Bill Smith was most helpful with difficult portions of the text; Greg Cleveland wrote the section on regional history, with editing by Ken Munsell. Responsibility for flaws that still exist, however, remains with the principal author.

EXECUTIVE SUMMARY

During the summer and fall, 1982, Central Washington Archaeological Survey (CWAS) conducted test excavations at 15 prehistoric sites in the vicinity of Columbia River Mile 590, near Belvedere, Okanogan and Douglas Counties, Washington. Our task, as outlined in the terms of Contract No. DACW67-82-C-0062 (as amended) between Central Washington University and the Seattle District, U.S. Army Corps of Engineers (COE) (1) was to determine the number of occupation zones at each site, their vertical position and horizontal extent, their age and position in the regional subsistence settlement system, and their information potential. In addition, we were to test the utility of Proton Magnetometer Survey as a means for identifying features in sites along the Columbia River. This report outlines the results of tests excavations at 13 of those sites: 45DO12M, 45DO189, 45DO190, 45DO191, 45DO394, 45OK165, 45OK193, 45OK198, 45OK199, 45OK205, 45OK207, 45OK208 and 45OK219. Work at sites 45OK196 and 45OK197 is not yet complete and will be described under a separate cover.

In this document, we 1) present the techniques used to test those 13 sites, 2) describe the data resulting from the tests, 3) discuss analysis procedures and results and 4) combine our findings with the already reported results of other archaeological research in the Columbia Plateau to generate a revised outline of regional prehistory. Site reports and site evaluations are included as appendices, along with descriptions and results of specialist analyses.

Techniques

Our testing approach was first, to obtain some idea of site extent through surface inspection, second to place 50cm and 1m square tests over the site area at 10m or 15m grid intersections, and third, to purposively place additional, clustered 1x1m units in areas that could best provide additional information about a site's age, function and the subsistence base of its inhabitants. After completing surface inspection and small scale tests, our Preliminary Test Excavation Phase, we determined the number of occupation zones at each site and mapped the vertical and horizontal extent of each zone. When necessary, clustered test units, our Secondary Testing Phase, were used to gather a larger sample of feature data, and stone, bone and shell artifacts. Sites that appeared to have the highest information potential (45OK207, 45OK208 and 45DO189) received the most attention during this second phase.

Analysis

Our conceptual scheme is evolutionary human paleoecology. Based on the neo-Darwinian concept of natural selection, this endeavor attempts to identify a sequence of human adaptations and to identify those selection forces that have occasioned the change from one form of adaptation to another.

Analyses focused on four topics of concern: identification of occupations, chronology, site function and resource utilization. We used three approaches to chronology (dating) including stratigraphy (position in a dated sequence of geologic layers), artifact chronology (dating on the basis of tool and ornament styles) and Carbon 14 dating.

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(1) Funds for excavation at Douglas County (DO) sites were provided by the Bureau of Reclamation.

To differentiate functional types of occupation zones (i.e., sites at which different kinds or proportions of activities were performed at various seasons of the year) we considered features, stone tools and the proportionate abundance of animal remains. The environmental distributions of the five settlement classes that resulted from this analysis (winter base camps and various short term field camps for food collection and processing) were considered for each of four time periods.

With this information we outlined changes in settlement pattern through time. Using data from animal remains and lithic (stone) material we also outlined changes in patterns of resource exploitation and use in time and space. In combination, data on settlement patterns and resource utilization were the basis for hypotheses generated about adaptive strategies of people living in the Study Area betwen 1600 and > 5000 years BP.

Through study of archaeological site stratigraphy, we outlined a sequence of sedimentary events (time stratigraphic units) that provided both a means for dating occupation zones and the basis for reconstructing changes in the riverine environment through time. We combined local data with geologic, paleontological and pollen records from elsewhere in the region to formulate a reconstruction of environmental conditions over the past 13,000 years.

From 10 of our 13 sites, we were able to discriminate 20 occupation zones. Two of these (45OK205 I and 45OK219 III are tentatively assigned to archaeological Period I (over 4700 BP). Six (45DO190 III, 45DO394 V, 45OK199 I, 45OK207 II, 45OK208 II and 45OK219 II) date in Period II (4700-3500 BP) and eight (45OK189, 45OK190/191 I and II, 45DO394 I-IV and 45OK219 I) date to Period III (3500-2500 BP). Period IV (2500-1600 BP), is the most recent period represented by the sites reported here; but only three occupations (45OK165; 45OK207 I and 45OK208 I) dated within that age range. We were unable to find any artifacts at 45OK198 and could not discern occupation zones at 45OK193 and 45DO12M. We later learned that site 45OK198 was incorrectly located on our maps; it has not actually been tested.

We discerned some interesting change in patterns of settlement among the four periods. Comparing settlement types against three variables (existence and kind of non-riverine water, degree of exposure to winter sun, and terrace location), we found that most sites in all periods occured near intermittent streams or no streams at all, that winter sun was correlated with winter/base camps but not with short term resource collection (field) camps, and that terrace position changed radically. The third phenomenon was related to changes in the riverine environment.

Both of our Period I occupations, probably short term field camps associated with opportunistic foraging, were situated on high terraces, over 20m above modern river levels. At this time, our research indicates that the river was very low, but subject to flash flooding on rare occasions. Winter or base camps may have existed near the river level but would have been buried or destroyed around 4700 BP, when flow rates suddenly increased and the Columbia began to raise its bed and form a floodplain several meters above the level of modern flood stages.

Between 4700 and 3700 years ago, the river was moving laterally and flooding frequently. This is a time of increased moisture and warm temperatures, (as indicated by pollen records and riverine geomorphology). People, apparently unwilling to build on the low, newly formed, frequently flooded river bars, constructed pithouses on the high terraces. However, the two short term field camps we found for this period were both situated on the active low-bar surface. Both represent

opportunistic foraging for animal foods (we know nothing of plant resource use).

The river continued to aggrade, building higher level floodplains that were subject to less frequent flooding. Once bars reached a level at which house construction near the river was feasible, winter/base camps were placed on the floodplain as well as on high terraces. Field camps (all hunting oriented) occured on both low and higher bars as well as on upper level terraces.

Floodplain building ended shortly after 2500 BP, and a cycle of erosion began. Flash floods, resulting from reduced vegetation and thus a less effective water shed, eroded older sediments from upland surfaces and the Columbia began to degrade (cut away) its floodplain and deepen its channel. All RM 590 sites dating to this interval are on high terraces. They represent two kinds of field camps, (plant [?] and animal processing) and a winter/base camp. Again, the river's activity seems to be responsible either for people's move to high ground or for the erosion of Period IV sites at the river level.

In addition to changes in settlement distribution, we observed differences in the geographic distribution of lithic material, the frequency of house re-occupation and the diversity of vertebrate fauna exploited for food.

We noted that jasper and chalcedony were more common materials on the river's north bank, opals and quartzite on the south bank. In addition, during Period II, quartzite was the dominant material in field camps, where expedient manufacture of simple tools seems to have occured, and that jasper and chalcedony predominated in base camps.

There were 10 probable housepits distributed among our sites. During periods II and III, only one of nine was used more than once, and nearly 50cm of sand was deposited between the two occupations. Our only Period IV house appeared to have been inhabited (seasonally at least) for a long period; at least three distinct floor layers could be discerned in the 60cm thick floor midden. These facts are indicative of a reduction in the frequency of base camp relocation between Periods III and IV. We also noted an apparent change in the degree of provisioning (large-scale harvesting, processing and storage of foodstuffs) between these periods. In Period IV there were two quite distinct kinds of field camp occupations, whereas only one kind of field camp occured during each of Periods I and II. Because of our small sample of sites, however, these observations are far from conclusive.

At 45OK208 II we uncoverd a 5300 year old (4600 radiocarbon years BP), shallow (30cm), ovoid housepit, unique both in terms of its age and structure; all later houses are round or square and about 1m deep. Whether these styles represent a change in house form from Period I to Period II, or whether the house at 45OK208 II is unique, we cannot say at this time.

Faunal utilization exhibited interesting changes. Aside from the ubiquitous river mussel, <u>Margaritifera falcata</u>, there are 16 taxa (species, genera or families of animals) represented in Period I and II occupations. Included are salmon or trout, deer and turtle (the dominants in house sites), an assortment of other ungulates (hoofed mammals) and large rodents, plus snakes, birds, dog/coyote and hares (probably jackrabbit).

By Period III there are only 12 genera and Period IV sites include only eight. The Period III/IV changes could be due to sampling error, but between Periods II and III there is a real loss of hares, dogs/coyotes, some rodents and snakes from the list of animals utilized.

Evidently, the spectrum of animals exploited for food and by extension the general pattern of foraging was becoming less opportunistic and people were becoming more systematic in their efforts to gather an adequate food supply. Possible reasons for this change are manifold, and are interesting topics for future research.

We also noted that in winter/base camps, deer was always the dominant ungulate present, wereas mountain sheep was more common in most short term field camps. We conclude from this that 1) deer were hunted from the base camp and returned there whole and 2) that sheep played a larger part in the diet than winter/base camp data indicate. Killed at a distance from home, the sheep were apparently boned out and only the meat taken to the base camp. This may also be true of other ungulates that occur in low frequency at base camp sites.

Evaluations

Four occupations (45DO189 I, 45OK208 I and II and 45OK165) have high information potential. All have good integrity and artifact patterning and good faunal preservation. Sites 45OK208 II, 45DO189 I and 45OK165 I include well preserved housepits from Periods II, III and IV, respectively. 45DO189, a single occupation site, can potentially provide valuable information on the patterning of activity within and outside the housepit and can thus help us better understand patterning observed in multi-occupation sites of its kind. 45OK208 contains the oldest known house structure in Washington and that structure is a unique, oval pithouse. This site can also provide us with data pertinent to the increase in site numbers that occurs around 4700 BP. Both 45OK165 and 45OK208 can help us understand little-known Period IV and the nature of change from Period III to Period IV.

Other occupations have either moderate (45DO190/191 [all], 45DO394 [all], 45OK207 I and II, 45OK205 I and 45OK219 II and III) or low potential.

INTRODUCTION

During the summer and fall of 1982, Central Washington Archaeological Survey (CWAS) conducted test excavations at 15 prehistoric sites in the vicinity of Columbia River Mile 590, near Belvedere, Okanogan and Douglas Counties, north central Washington (Figure 1; Plate 1). Our task, as outlined in the terms of Contract No. DACW67-82-C-0062 (as amended) between Central Washington University and the Seattle District, Corps of Engineers (COE) was to determine the number of occupation zones present at each site, their vertical position and horizontal extent, their position in the regional subsistence-settlement system, and their information potential. In addition, we were to experiment with the proton magnetometer as a means for locating subsurface features without excavation. Evaluations of information potential were presented in Management Plan Information reports prepared in October, 1982 and January, 1983; they are included in Appendix A. This report outlines the other results of test excavations at 13 of the 15 assigned sites: 45DO12M, 45DO189, 45DO190, 45DO191, 45DO394, 45OK165, 45OK193, 45OK198, 45OK199, 45OK205, 45OK207, 45OK208 and 45OK219. Work at sites 45OK196 and 45OK197 is to be completed in September, 1983, and will be described in a separate report.

The Chief Joseph Dam Cultural Resources Program (CJDCRP)

The Seattle District, Corps of Engineers has developed, funded and administered cultural resource investigations behind Chief Joseph Dam since 1976. Required by Federal cultural resource and environmental legislation, the project was undertaken to identify and mitigate impacts of a 10 foot rise in the level of Rufus Woods Lake. Work began with a reconnaissance by District staff (Munsell and Salo, 1977) and has continued through six years of test excavation, data recovery-type mitigation, and analysis by the University of Washington Office of Public Archaeology. CWAS became involved in 1982, when an additional set of sites was made available for testing. In all, the Corps of Engineers sponsored investigations have recorded 251 historic and prehistoric sites, tested 92 sites (mostly prehistoric and historic Native American) and conducted data recovery at 18 of these sites.

In 1982, the Bureau of Reclamation provided funding to the Seattle District for test excavations at five sites that might be adversely affected by tailwaters from the third powerhouse at Grand Coulee Dam. These sites were tested by CWAS in October and November, 1982 and are the Douglas County (DO) sites reported here.

Report Content.

Our intent in this document is to: 1) present the techniques used to test 13 archaeological sites and analyze the artifacts and records resulting from those tests; 2) describe resultant data and 3) interpret those data from the viewpoint of evolutionary human paleoecology, which uses the paradigm of neo-Darwinian evolutionism in order to explain changes in the adaptive strategies of prehistoric human populations.

This introduction includes sections describing the Study Area and previous archaeological research in Rufus Woods Lake, together with a discussion of the conceptual framework that guided our analysis and interpretation of RM590 data. Chapter II reviews data collecting techniques; Chapter III discusses identification of occupations.

Plate 1. Aerial view of RM 590 Study Area, from the Northwest.

Chapters IV through VII deal with chronology. Artifact and settlement classifications appear in Chapters VIII and IX. Our conclusions are presented in Chapters X, XI and XII, dealing respectively with environmental reconstruction, settlement pattern, and a revised model of Columbia Plateau prehistory.

Site reports, the results of specialized analyses and site research potential evaluation are presented as appendices.

Personnel.

Principal investigator and director of this contract is Dr. James Chatters; Mr. Gregory Cleveland and Ms. Chris Miss were site supervisors. Mr. Cleveland conducted the lithic analysis, Dr. Chatters the faunal and geologic studies. Dr. Lawrence Leney of the University of Washington identified plant charcoal; Mr. Bruce Cochran and Dr. Charles Knowles of the University of Idaho identified volcanic tephra and Mr. Lee Sappington identified obsidians. Illustrations were prepared by Mr. James Baugh, graphics by Ms. Marilyn Morrison. Mr. Mark Bowers was our computer specialist; Ms. Monica Ekiss typed the text.

Dr. William C. Smith provided invaluable assistance during the preparation of this report, both as a sounding board for ideas and as an editor.

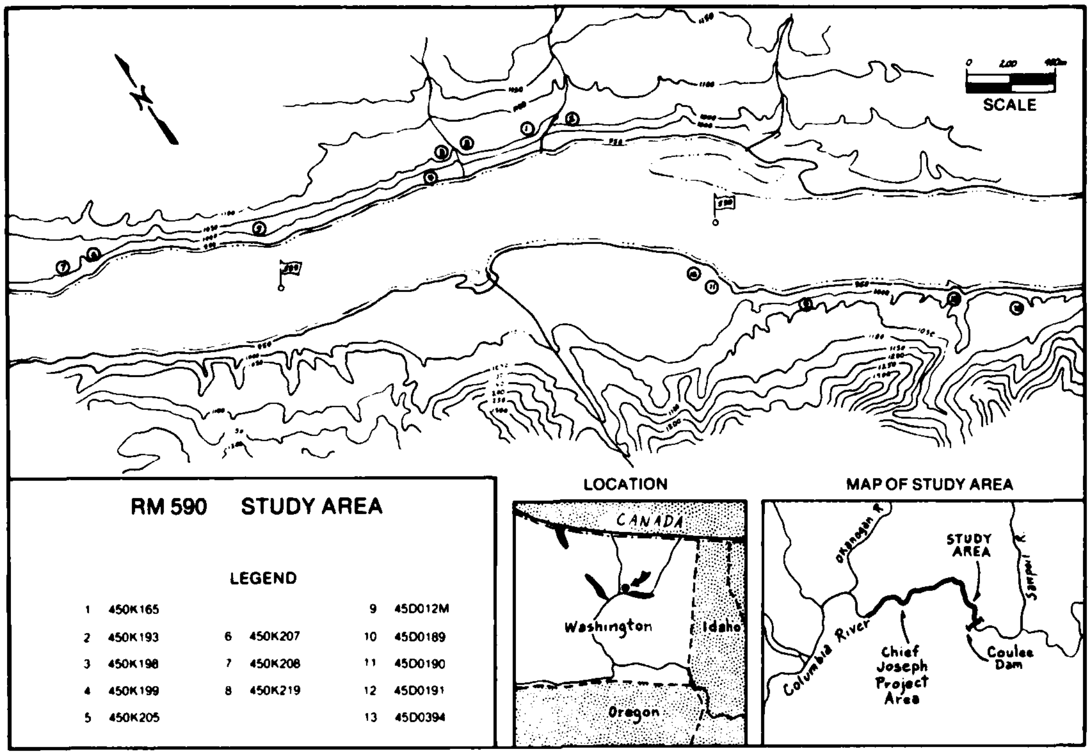


Figure 1. Map of RM 590 Study Area, in regional context.

The Study Area

This study entails test excavation at 15 prehistoric archaeological sites on both sides of the Columbia River between RM 589 and RM 591. In this area, as for much of its length in northern Washington, the Columbia flows through a narrow gorge. To the north are granite and basalt bluffs and low mountain ridges of the Okanogan Highland. To the south, the rolling Waterville Plateau stretches southward from basalt rimrocks. Evidence of former glaciation and the existence of glacial Lake Columbia are especially evident here. Lacustrine sediments form a series of ever narrower, lower terraces beginning at the 1800 ft. level and, after as many as six steps, reaching to 1000 feet m.s.l. On the 1400 ft. level is the community of Belvedere, stretching along State Highway 155 for a mile above RM 589 - RM 590. Glacial erratics, most of them massive basalt boulders plucked from the nearby bluffs, occur on both sides of the river from Belvedere westward. Left behind when finer sediments were washed away, these erratics stand on all terrace levels. Occasionally they occur at river level, where they formed rapids before the closure of Chief Joseph Dam (e.g., the 45DO214 vicinity today).

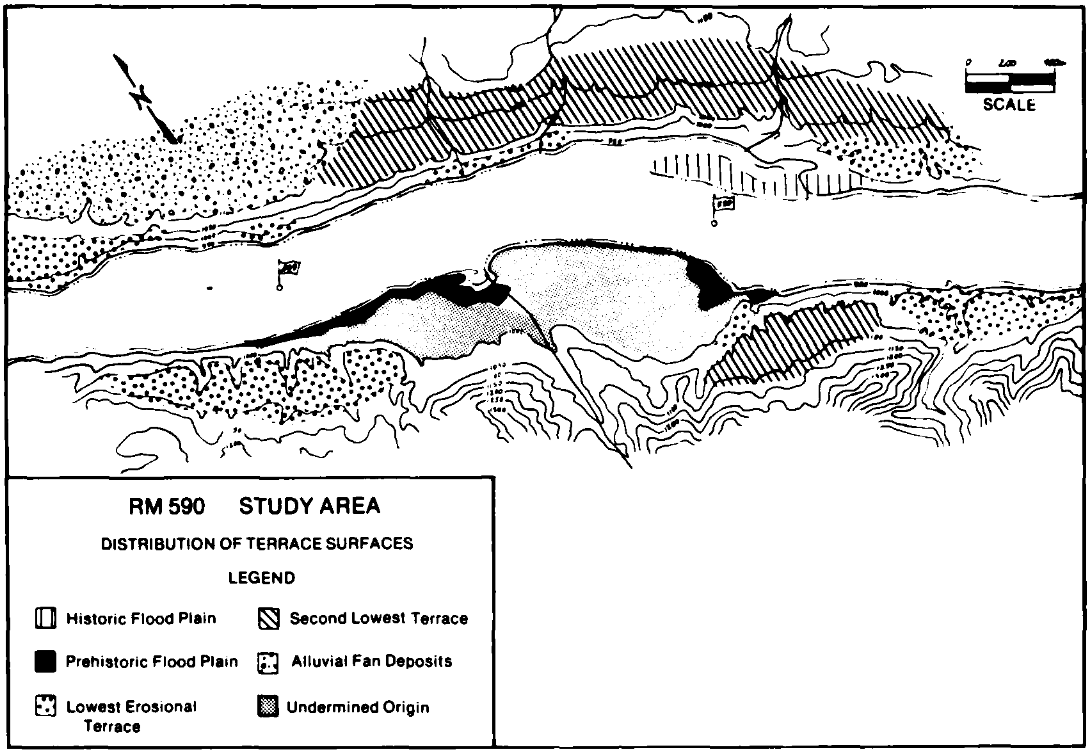


Figure 2. Map of RM 590 Study Area: distribution of terrace surfaces.

Environmental Setting.

Working upward from river level there are four terrace levels within our Study Area, a follows:

T0. 956-965 ft. m.s.l.
T1. 965-980 ft. m.s.l.
T2. 1000-1050 ft. m.s.l.
T3. 1100-1150 ft. m.s.l.

Locations of each terrace level are shown in Figure 2.
On the north bank, the T3 level is known locally as Owsley's Bench.

There is a fifth terrace level, the origin of which is unclear, on the river's south side. This is a broad, level, fan-like gravel surface called Sanderson Creek Bar. It corresponds to no other terrace surfaces in the Project area or within five miles up or downriver. It may simply be an alluvial fan, but its levelness and the large size of gravels indicate a fluvial origin. Its elevation is 580-595 ft. m.s.l., placing it between T1 and T2.

No large streams enter the Columbia in the Study Area; the nearest is the Nespelem River, several miles downstream. There are, however, several small spring-fed creeks on the river's north side and one larger creek on the south side. Several intermittent streams with basins ranging from a few square kilometers to under 200 hectares drain runoff in the spring, but otherwise are dry. Lacking local names for many of these channels, we have labeled the perennial streams and several of the larger intermittent ones (Figure 2). On the north bank moving upriver are Fan Creek, with its East and West forks (intermittent); Corral Creek (perennial); and Orchard Creek

(perennial). On the south bank, beginning on the Sanderson Creek Bar are Sanderson Creek (perennial, an official name), and First through Fourth South Draws (all intermittent runoff channels).

Our Study Area is, of course, dominated by the Columbia River. Now a regulated pool behind Chief Joseph Dam, the river formerly underwent marked annual fluctuations in flow volume and water surface elevation (Figure 3).
Annual discharge during the years 1922-1933 averaged 110,000 cubic feet per second(c.f.s.), but varied from less than 50,000 c.f.s. to over 300,000 c.f.s. between winter and late spring. In fact, the three months during which snow melted off the Canadian, Montana and Idaho Rocky Mountains, May through July, averaged over four times the flow from September through April.

Because the river flowed so rapidly through the Study Area, the Columbia's banks resembled a gravel and sand-lined trough. During winter, the river covered only the bottom of its chute, but in early summer the chute was full and often overflowed onto the narrow TO floodplain. One consequence of this annual flow pattern was a lack of arboreal vegetation or even many shrubs growing in the river's trough or along it's banks (evidence contained in 1930 aerial photographs).

On the average, 100,000 c.f.s of the river's 110,000 c.f.s. flow came from 74,100 square miles of northern Idaho, northwest Montana, Northeast Washington and southeastern British Columbia; little of it was local. Annual precipitation in the Study Area (Grand Coulee Station) is under 10 inches (25cm), falling mainly between November and January. Temperature is continental, ranging from 109 degrees F (43 degrees C) to -22 degrees F (-30 degrees C). January mean temperature is 30 degrees F (-1 degrees C); July mean is 72 degrees F (22 degrees C). Temperatures are cooler and precipitation greater in highlands to the north.

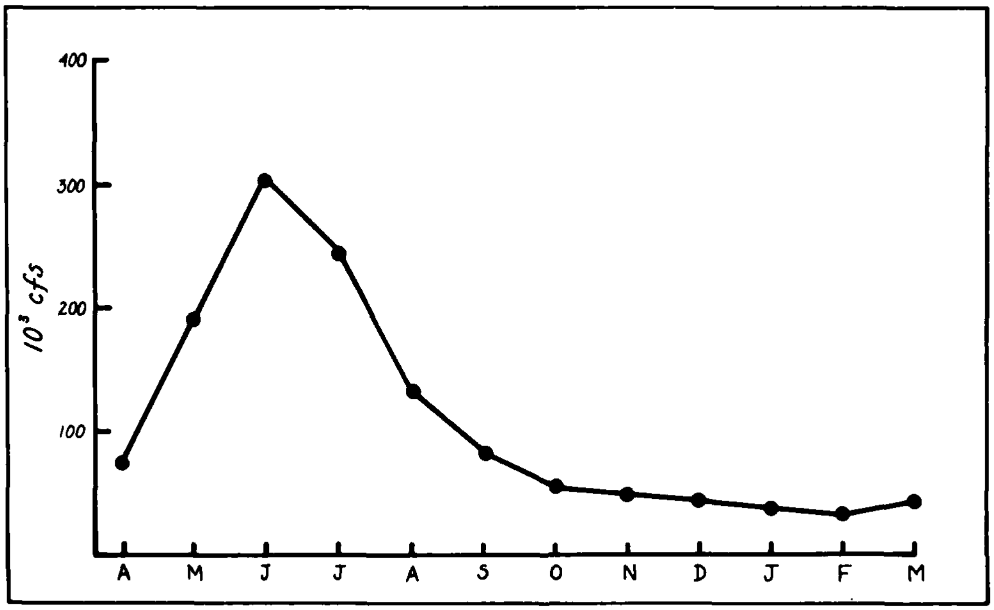


Figure 3. Mean monthly discharge of the Columbia River at Grand Coulee between the years 1913 and 1934.

The semi-arid climate now supports a steppe form of vegetation, a part of Franklin and Dyrness' (1973) Upper Sonoran Life Zone. There are three distinct communities within this zone. These are, in order of their abundance, the steppe, riparian and slope communities.

Steppe flora is the most consistent, with sagebrush (Artemisia spp.), and either cheatgrass (Bromus tectorum, a non-native grass) or some species of native bunchgrass (c.f., Agropyron, Festuca, Poa, Stipa) forming the principal ground cover. Forbs such as lupine (Lupinus spp.), balsam root (Balsamorhiza), and various annual composites are present, but none are plentiful. Steppe covers T1, T2 and T3 surfaces and gentle slopes between some of them. Unfarmed portions of Sanderson Creek Bar are also in steppe.

The riparian community contains a great variety of woody plants, grasses and forbs. As the largest plants, deciduous brush and trees are the most recognizable elements of this flora. Hawthorn (Crataegus sp.), serviceberry (Amelanchier spp.), chokecherry (Prunus virginiana), wild rose (Rosa spp.), sumac (Rhus glabra) and dogwood (Cornus spp) are common along with sedges (Carex spp.), ryegrass (Elymus cinereus), poison ivy (Rhus radicans) and dandelion (Taraxacum spp). Wet slopes, stream bottoms and riverbanks are the habitats of the riparian community.

Dry slope flora is much like the steppe in appearance, but instead of sagebrush, the dominant large woody shrub is bitterbrush (Purshia tridentata). Some ryegrass, prickly pear (Opuntia spp.) and Indian rice grass (Oryzopsis spp.) also occur in this community, along with common steppe plants.

Modern fauna of terrestrial environments are primarily mule deer (Odocoileus hemionus), black bear (Euarctos americanus), coyote (Canis latrans), porcupine (Erethizon dorsatum), striped skunk (Mephitis mephitis), weasels (Mustela spp.), ground squirrels, and chipmunks of various species (Spermophilus and Eutamias, respectively), plus various large ground-dwelling birds (e.g., grouse, pheasant, chukar), song birds and mice.

In the rocky slopes dwell yellow bellied marmot (Marmota flaviventris) and rattlesnake (Crotalus viridus); muskrat (Ondatra zibethicus). Beaver (Castor canadensis), and the painted turtle (Chrysemys picta) are the aquatics.

Today, there are few fish in Rufus Woods Lake, the most common seemingly large-scale suckers (Catostomus macrocheilus) and Carp (Cyprinus carpio). Various species of trout (Salmo spp.), squawfish (Pteichocheilus oregonensis), chub (Mylocheilus courinus), mountain whitefish (Prosopium williamsoni) and burbot (Lotta lotta), the remaining large native fishes, are also present, along with various introduced species. Formerly, salmon (Oncochynchus spp). and steelhead trout (Salmo gairdneri) migrated upriver to spawn. Chief Joseph Dam has blocked that migration, and anadromous fishes no longer pass through the Study Area.

When salmon runs did occur, they began in May with the spring chinook (O. tschawytscha) and continued well into November with various smaller species.

Modern Land Use.

Except for portions of Sanderson Creek Bar, the Study Area is unused except for stock grazing and hunting. However, the occurence of more intensive human activity, both historic and prehistoric is evident from the abundant number of archaeological sites. Figure 4 shows historic Native- and Euro-American Sites, Figure 5 the

Table 1. Historic Archaeological Sites and Unrecorded Historic Features in the Study Area[1].

Site	
45DO190H	Stone-lined foundation or root cellar (homestead).
45DO194H	The Sanderson Ranch and Barry Townsite (platted only). Includes south station of Steveson (Barry) Ferry.
45DO209H	Placer mine tailings.
45DO210H	Root cellar and associated Euro-American debris (homestead).
45OK173*	Historic dump (of Barney Owsley) and early 20th century homestead (Indian allotment?) remains.

[1]Locations after Munsell and Salo (1977), see Figure Hm.

*Recorded by Lyman (1976) but deleted from Munsell and Salo (1977).

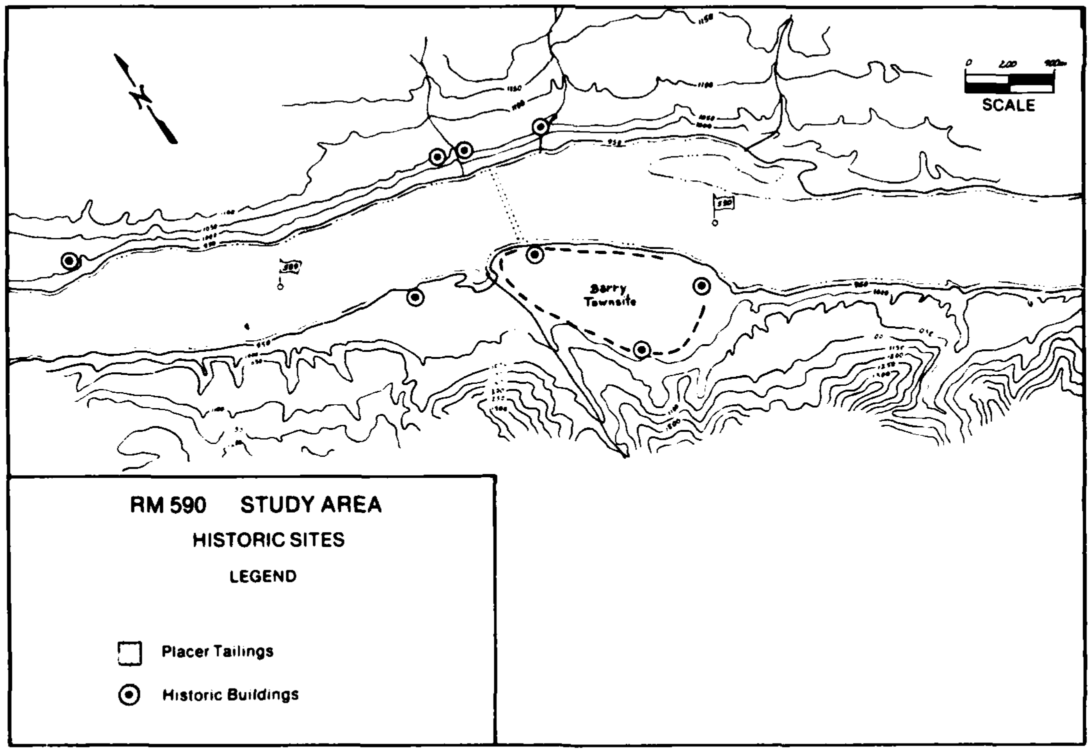


Figure 4. Map of RM 590 Study Area: locations of historic sites.

prehistoric ones (See also Tables 1 and 2).
The late nineteenth and early twentieth centuries were the periods of most-intensive historic activity. The Barry townsite, placer mines, several Indian homesteads and the Steveson (or Barry) Ferry were then in use. By the 1930s, there were several construction workers' houses on the slopes above T3 (north bank) on property now owned by Barney Owsley of Belvedere. The Ferry shut down in the late 1930s and dam workers moved out.

One Native American archaeological site (perhaps the 45OK6 of Osborne, 1952) was inhabited in the early historic period, according to Ray's (1932) informants. This place, a semipermanent camp called Salqua'xuwi'x or "where the trail meets the river", may have been the large cluster of housepits situated on a T0 point bar opposite the north end of Sanderson Creek Bar. Aerial photographs taken in 1930 show up to 20 distinct housepits on that spot. Dates of occupation for other prehistoric archaeological sites were unknown prior to our test excavations. Only one site, 45DO211, so far has been excavated by the University of Washington. Although the report is not yet completed, preliminary results show occupation beginning over 5000 years ago (Lohse 1983a; Jaehnig 1983).

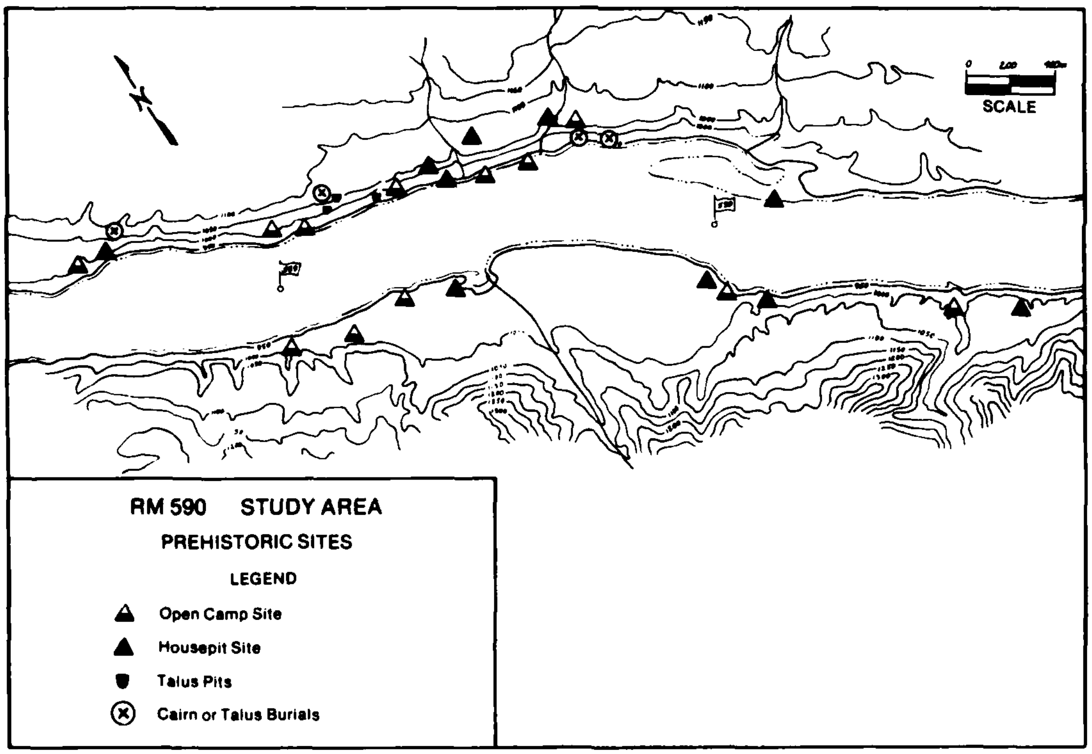


Figure 5. Map of RM 590 Study Area: locations of prehistoric sites.

Table 2. Prehistoric Archaeological Sites in the Study Area and Vicinity[1].

Number	Evaluated	Description
45DO12M	X	Open site with possible housepit
45DO189	X	Housepit site, single house
45DO190	X	Open site with one or two housepits
45DO191	X	Open site (part of 45DO190)
45DO193		Open site with two housepits and associated midden
45DO211	CJDCRP	Open site with shell midden
45DO212		Open site with shell midden
45DO213		Open site, FCR only observed (on beach, largely eroded?)
45DO394	X	Open site with shell midden
45OK6 (Munsell and Salo 1977)		Open site with midden deposit
45OK6 (Osborne(?) 1948, 1952)		Open site with numerous housepits
45OK165	X	Open site with four "housepits" (actually historic cellars)
45OK192		Two clusters of talus pit burials
45OK193	X	Open campsite
45OK194	X[2]	Open campsite
45OK195		Eroded midden deposits
45OK196	X	Open campsite with midden deposit
45OK197	X	Midden deposit with single housepit(?)
45OK198	X	Housepit site
45OK199	X	Open site with shell midden
45OK200		Two large talus pits
45OK201		Cairn (burial?)
45OK202		Two burial cairns
45OK203		Talus burials
45OK204		Open campsite
45OK205	X	Open campsite
45OK206		Open campsite
45OK207	X	Two housepits in open site (and nearby burials in talus).
45OK208	X	Open campsite
45OK219	X	Open housepit site

[1]Based on data available prior to our test excavations

[2]Removed from project when burial cairns discovered

Summary of Geologic History

The geologic history of a region is a sequence of large-scale, long-duration events that shape the landscape with which human beings interact. While events that took place in the Cretaceous (over 70 million years ago) and that themselves took millions of years to manifest may seem irrelevant to the activities of people, (who only recently arrived) quite the reverse is true. Geologic events have brought about the form of north-central Washington, creating hills, mountains, plains and river systems which, in concert with climate and ecological succession have determined the distribution of plants and animals. These, in turn, along with water and mineral resources, imposed strong selection pressure on the form of human subsistence systems and the size of human populations, not determining but greatly influencing the archaeological record we perceive today.

In the north-central part of eastern Washington, the southward flowing Columbia emerges from mountainous terrain to proceed westward, forming a border between the Okanogan Highlands on the north and the Columbia Basin on the south. The Highlands, composed primarily of metamorphic and intrusive igneous granites are the product of an ancient orogeny (period of mountain building) which began in the later Mesozoic and early Cenozoic (around 60-80 million years ago). Mountain building slowed in the mid to late Cenozoic era. Then, in the Miocene epoch (7-15 million years ago) great rifts formed in the surface of the low-lying, mountain-fringed Columbia Basin. Fluid, basaltic lava began flowing over the rolling terrain, forming immense lakes of molten rock, which hardened into beds of basalt sometimes over 100 feet thick. Repeated eruptions added layer upon layer, until the basin was filled with deposits thousands of feet thick, lapping up against the ancient granite highlands. This contact can be easily seen in the upper Grand Coulee, near Steamboat Rock.

Subsequently, waters draining from mountainous areas of what are now Montana, Idaho and British Columbia, which had once taken a southward course, were deflected along the contact zone between basalt plains and granite highlands. As renewed orogenesis continued to raise the Okanogan Highlands and parts of the adjacent lava plain, the river cut a deep canyon west from the Spokane River mouth, north through a now-abandoned channel known as the Omak Trench to Omak, thence southward via the modern-day Okanogan River Canyon.

The Pleistocene epoch (last 1-4 million years) was characterized by repeated episodes of glacial advance, during which ice masses hundreds, even thousands of feet thick flowed from the Okanogan Highlands onto the lava plain. During one early glaciation, ice advanced over what is now the Omak Plateau, deflecting the Columbia River from the Omak Trench, down along the ice front. The glacier was stable long enough for the ice-marginal river to cut a new stretch of canyon between the south end of the Omak Trench and the present mouth of the Okanogan River.

During the most recent, Fraser glaciation, there were three episodes or stades, of ice advance: the Evans Creek (25,000-20,000 BP), Vashon (17,000-13,000 BP) and the Sumas (11,000-9000 BP) (Richmond et al. 1965). Evans Creek and Vashon ice extended across the Columbia onto the Waterville Plateau, with the maximum extent coming around 14,000-15,000 BP during the Vashon stade. After the Vashon maximum, glacial ice wasted in place on the Omak and Waterville Plateaus, forming the pock-marked, kettle and kame topography of those areas (Flint, 1935).

Sometime after the Vashon maximum, when ice had wasted from the upland areas, a glacier blocked the Columbia near the south end of Omak Trench (Hibbert 1980; Kiver and Stradling 1982), forming a deep glacial lake, Lake Columbia (Flint and Irwin 1939). Filled to a level near 520m (1800 feet) in the project area, the lake produced wave-cut terraces and became nearly filled with fine sands and silts of the Nespelem Formation (Flint and Irwin 1939). As this ice dam wasted

away, the Columbia rapidly cut through the fine glaciolacustrine Nespelem silts. Several times during that period of erosion, either the river's base level stabilized, or its flow was abruptly reduced, causing the formation of river-cut terraces. The most prominent of these terraces in the project area occur at approximately 440m (1430 ft.), 380m (1235 ft.), 325m (1100 ft.) and 310m (1000 ft.). Mount St. Helens S ash has been found interbedded in the 520m terrace, dating that lake level at around 13,000 BP. Glacier Peak ash from an eruption dating 12,600 or 11,200-11,300 BP has been found on the 380m terrace (Kiver and Stradling 1982). Mazama ash, with a date of 6700 BP, is the oldest tephra found on the 325m and 310m terraces (Hibbert 1980; Chapter VI). Thus the incision of glaciolacustrine sediments proceeded rapidly, and between 13,000 and 11,300 years ago, the river had cut its way below the 380m level, probably reaching the 310m elevation well before 7000 BP.

At sometime in the early or mid-Holocene, the Columbia had reached the base of lacustrine sediments to a level at or below its historic bed. Thereafter, a final pre-modern terrace was formed; this time a depositional terrace resulting from a period of floodplain development (aggradation). Radiocarbon dates from archaeological layers at base alluvium in several remnants of this terrace range from 4600 BP at 45DO190/191, 3700 to 4000 BP at 45DO204 and 394 and at 45OK2, 288 and 18 (Campbell 1983; Jaehnig 1983). Top dates on this same alluvium are 3363+-294 at 45OK18 (Jaehnig 1983) and 2812+-344 at 45DO204 (Lohse 1983C).

Aggradation therefore seems to have come to an end sometime after 2800 BP and the river again became oriented to a lower base level. More recently, minor aggradation has occurred, but aside from narrow interfan terraces, (e.g., 45OK196, 197) perhaps the development of low point bars, and deposition of a few historic flood deposits atop the mid-Holocene terrace just described, little floodplain building is evident. In the study area, the historic pre-dam Columbia River was a swift stream with numerous rapids created by exposed bedrock and glacial erratics.

Regional History

Native inhabitants of the RM 590 vicinity were and still are the Sanpoil and Nespelem, members of the Interior Salish language family and participants in Plateau culture. Students of Sanpoil-Nespelem history generally conclude that the tribe remained isolated from contact with Europeans and Americans in the 19th and early 20th centuries (Ray 1933, W.C. Smith 1977, A.H. Smith 1982). The people remained aloof throughout five distinct phases which include, the importation of new, devastating diseases into the culture, the fur trade period, the era of mining and cattle drives, farming settlement, and the establishment of the reservation.

The Sanpoil Nespelem Before Contact with Euroamericans

Researchers cannot rely too heavily on early accounts of travelers and fur traders for an accurate picture of the culture of the Sanpoil-Nespelem as it existed before contact with Euro-Americans because the advent of cyclical epidemics of European-induced diseases seriously disrupted the culture even before the first contacts. However, these accounts do give a general picture of native life.

Alexander Ross, an employee of Astor's Pacific Fur Company, and later with the Northwest Company and the Hudson's Bay Company visited the lands of the Sanpoil-Nespelem in the early 19th Century. He observed that the people lived in multi-family winter houses or communal mat lodges and that supplies stored away for winter were considered common to all in the lodge. He also described the mechanics of local salmon fishing. Ross said that a salmon chief oversaw the fishing while women distributed the catch to the families. Weirs were built communally (Chance 1973).

Ross observed a four-part division of labor. Two male groups dealt with fishing and hunting while two female groups processed salmon and gleaned roots and berries (Ross 1870).

David Thompson reached the Sanpoil country in the summer of 1811 and described the inhabitants:

> The men are all of mid-size, well made. The women were all of a rather small stature, clean made, and none of them seemed to labor under any bodily defect (Elliot, 1914).

As for living conditions he had this comment:

> Their huts are of slight poles tied together, covered with mats of slight rushes, a sufficient defense against the season, and they were considered altogether as moderately cleanly, a though very poorly clothed, especially the men, as animals are very scarce and they are too poorly armed to obtain any spoil of worth from the chase. They have a good weir in a brook of about 15 yards (Sanpoil River), but only small salmon come up to it, some very poor, others tolerably good.

He then described the animals common to the local tribes, "Of course there can be no beaver, they have bears and rats with a few sheep and black-tailed deer. Horses they have many and the country appears good for them." (Elliot 1914).

Settlement and subsistence.

The Sanpoil and Nespelem were hunter-gatherers with an adaptive strategy that Binford (1978, 1981) would call a logistic, collector strategy. They maintained year-round base camps from which groups of varying size would travel, collecting provisions and storing them for the cold, unproductive winter months.

According to Ray (1932), late winter found the Sanpoil-Nespelem in winter camps of semi-subterranean, circular pithouses and elongate mat lodges. With the arrival of warmer weather, around March, people moved out of winter quarters into nearby, temporary camps for a change of surroundings and to escape the by-then stifling atmosphere and confinement of the winter houses. During this period of two to three weeks duration, the women dug edible roots in the hills along the river and men hunted small game and gathered shellfish.

Around April, small groups of families would disperse from the river, moving to their favorite root-gathering grounds in the plateau south of the Columbia River. Moving frequently from field to field, the women spent this time gathering and processing much of the year's supply of roots. Men engaged in some hunting, but generally stayed around the small, conical mat huts that constituted the seasonal camp. During this and later seasons, very old and crippled people remained in winter villages tended by a few of the able-bodied.

The men's labor began in May, when they began fishing for suckers and other resident fishes. Summer camps were set up at favored fishing grounds either near the winter village or at one of the optimal fish intercepting locations at Kettle Falls and the mouths of the Sanpoil and Spokane Rivers. Groups of a few hundred people would often congregate in these latter areas (Ray 1933; Elliot 1914). By late May, the salmon run began, and fishing commenced in earnest. Men constructed wiers and caught the fish; some women cooked and dried the fish while others collected berries. Toward August, as summer fish run declined, people moved camp frequently in search of better fishing spots.

By September, people divided into groups pursuing different sources of food. Some moved to fall fishing grounds to amass stores of salmon and steelhead for winter. Others journeyed into nearby mountains to gather fall roots and to harvest deer. Deer were hunted in drives and when possible, killed in large numbers. Animals were boned and the meat dried at hunting camps.

When cold weather began to set in, usually by mid-October, fish and meat harvesting groups returned to the winter base camps with their produce. After they had placed all dried roots, fish, berries and meat into nearby storage, these groups settled into a winter of implement manufacture, idleness and ceremony in the pithouses and mat lodges. In March, the cycle began again.

The coming of the Euro-Americans and their associated diseases gradually affected this way of life. Compared to other areas of Eastern Washington, however, this area was only indirectly influenced.

Disease

The first Euro-American contact with the inland tribes of the Pacific Northwest was made not by individual persons, but instead, by disease. Long before actual physical contact, coastal traders left behind diseases unknown to local tribes and from which the native people had no defenses. These diseases had a devastating effect on Native-American populations. The first smallpox epidemic, alone, killed between one-third and one-half of the coastal population of the Pacific Northwest. Soon, contact between tribes spread the diseases inland and up the Columbia River.

Verne Ray (1932) states:

> It is exceedingly difficult to calculate with any degree of accuracy the number of individuals constituting the Sanpoil prior to the 19th Century. In 1782 began a series of epidemics which greatly depleted the population throughout the area. Smallpox made the most serious inroads, but measles and influenza caused considerable loses as well.

The 1782 epidemic initiated a series of disease outbreaks continuing throughout the following periods of Euro-American interaction with the Sanpoil-Nespelem. The grim cycle of disease killed most of the people and depopulated the countryside, seriously disrupting accepted cultural patterns, demoralizing the tribes, and leading to increasingly strained relations with the Euroamericans as Native-Americans increasingly identified the scourges with the arrival of the new people into their lands.

Diseases thus prevented the incoming Euro-Americans from ever experiencing the native culture as it had flourished to the late 1700s and resulted in an interethnic distrust never alleviated by subsequent events.

The Era of Initial Exploration and the Fur Trade: The Northwest Company and the Hudson's Bay Company

David Thompson first descended the Columbia River in 1811. A cartographer for the Northwest Company, he was in a hurry to claim the Pacific Northwest for Britain but, along the way, he stopped to trade and visit with the local peoples and establish a trading relationship between them and the Company. After this initial contact, the British of the Northwest Company and later the Hudson's Bay Company, remained the dominant outside economic force in the Upper Columbia River Native American economy (Chance 1973).

The fur trade began in earnest shortly after this first visit. Chance (1973:3), however, comments that the Sanpoil produced little fur and made only sporadic visits to Hudson's Bay Company posts. This was partly because of a lack of a natural habitat for fur-bearing species and also because of difficulties in navigating the stretch of the Columbia River between the mouth of the Spokane River and the mouth of the Okanogan. This, in part, led Verne Ray (1933:19) to describe the people as "one of the groups least affected by direct influences from other areas."

Chance (1973:136) said that the Sanpoil-Nespelem "are an example of a tribe with a high population density that was adjacent to a post, but which nevertheless seems to have traded little after 1829." This seems to reflect the general conservatism found among the other Colvile District Indians. They traded sparingly but did have favorite European goods. Tobacco was quickly accepted and the demand is reflected in Hudson's Bay Company records. Guns, knives and axes remained popular items (Glover 1962:380). Although the inhabitants traded for these items, (Chance 1973:41) reported the continued use of stone and bone technology in projectile points and leisters, respectively.

The relative lack of river traffic further accounts for the isolation and conservatism of the Sanpoil-Nespelem. Except for the annual run by the fur traders from Fort Colvile to Fort George (Vancouver), no regular river traffic could be expected. Even in the period between 1812 and 1818 when the Canadian Northwest Company had established two major trading establishments, Fort Okanogan and Spokane House, little contact occurred. Although the logical method of travel would have been by river, rapids and the difficulty of dry land passage near the Columbia demanded an overland route that bypassed the Sanpoil-Nespelem country.

Columbia River Placer Mining

After the depletion of fur bearing species in the Colvile area and with the Oregon Boundary settlement of 1846 which placed most of the Colvile District under United States supervision, the next major intrusion into the Sanpoil-Nespelem region came with the discovery of gold and silver in placer deposits along the banks of the upper Columbia River and its tributaries. This led to a series of minor rushes into the area. None left lasting settlements, but they instead followed the boom/bust pattern of most mining rushes. The miners built temporary camps and moved on as soon as the deposits were spent. Chinese placer miners were the most persistent, but even they did not become permanent settlers.

The first wave of miners appeared in the Colvile district in 1855-56, a shortlived flurry of prospecting and placering activity on the mainstream bars and tributary deposits of the upper Columbia River (Trimble 1914, Meinig 1968). The miners' success, however, was apparently short-lived. Trimble (1914:16) reports:

> The reports brought back, a number of which were made by reliable and conservative men, were of such a nature as to inspire further efforts. It seemed that gold could be found almost anywhere between the Spokane and the Pend d'Orielle, but that the deposits were small and superficial. Still, men made with pan and rocker three to six dollars per day, and a few twelve. Explorations many miles up the Fort Colvile told the miners that chances were better farther up the Columbia a suggestion not without fruit in the later discovery of mines on the Fraser River.

Just as Hudson's Bay Company trails bypassed the Sanpoil-Nespelem during the fur trade, supply lines to the miners also bypassed the tribes although the presence of more non-Indians in the general area led to scattered conflicts and some increase in trade. The first gold rush ended soon after it began as the miners rushed onward to the newly discovered gold deposits on the Fraser River in what is now British Columbia. The miners rebounded back to the Colvile area in 1858-60, further depleting the marginal placer deposits. Later, in the 1870s and 1880s, Chinese gleaners worked the bars, many of which had already been worked extensively and abandoned (Symons 1967:27). The transient miners quickened the pace of the Euro-American-Native American interaction, but impact on the Sanpoil-Nespelem remained fleeting.

The Politics of Encroachment and the Advent of Settlement

The United States Congress placed Issac I. Stevens, the first governor of a separate Washington Territory, in charge of making treaties and establishing reservations with various Indian tribes in the vast territory. He reached agreements with most of the tribes in 1855, but failed to negotiate one with the Sanpoil-Nespelem and their neighbors (Josephy 1965). The lack of a treaty left a broad band of non-treaty Salish lands which included the Sanpoil-Nespelem and covered the northern one-third of Washington Territory. Proposals for a Salish reservation were raised intermittently during the next fifteen years, but Congress gave the question little serious consideration (Wilner n.d.; Hedges 1930).

Meanwhile, settlers began to come into the region and cattlemen drove their herds through the lands. Indian agents were forced to make on-the-spot adjudications and hostile feelings abounded on both sides (Oliphant 1968:312). Events of the late 1850s and early 1860s demonstrated that the new settlers had come to stay and would eventually relegate the Salish to reservations.

Until the government reached an agreement with the non-treaty Indians, settlers in the Colvile area were technically trespassers, unsure of their rights and aware that a Salish reservation that included the Colvile Valley would put a stop to future growth. No treaty existed with local Indians and no overt act of war had occurred that would have provided an excuse for appropriating land from the native peoples.

A number of events prepared the way for the eventual establishment of the reservation. In 1859 Ruckel and Olmstead had completed a wooden tramway around the Cascades of the Columbia and steamships began plying the Columbia upstream from The Dalles. Then, in 1862, Col. John Mullen completed a 624-mile wagon road into the territory (Trimble 1914) Because of these events and the opening by the military of areas of eastern Washington to settlement, a steady flow of settlers began to appear in Sanpoil-Nespelem territory.

Negotiations that led to the final establishment of the reservation satisified neither the settlers nor the Salish. At least two councils were held with the Salish, one at Spokane Prairie and the second in the Sanpoil country. During the second meeting the Sanpoil representative, Kimatalikyah, "attacked the moral authority of the American government to expropriate Indian lands, expatiated on Sanpoil independence, and in no uncertain terms rejected the reservation, while asserting Sanpoil resolve to remain undisturbed in their own country" (Wilner, n.d.). On the other hand, settlers in the Colvile Valley found that the reservation boundaries inadvertantly included that rich area. Incensed, they petitioned President Grant who redrew the boundary to exclude the Valley in his Executive Order. No effort was made to consult with the Indian peoples about these changes until they were already made. Then, Indian agent John Simms held an ex post facto council near Kettle Falls to inform the Indians of the boundaries and plans for their

resettlement. The Sanpoils and Nespelems were conspicuously absent from this council and apparently no effort was made to inform them of the establishment of the new reservation (Wilner n.d.). Ultimately, the boundaries became effective and "off reservation" homes, fields and other developments were relinquished by the Indian peoples east of the Columbia River.

Beginning with the attitude of General Wool toward the miners of the 1850s, the United States Government had adopted a policy of fostering and then protecting white settlement and development. Ultimately the Sanpoil-Nespelem were forced to submit to the reservation and acquiesce to the advent of the American settler society.

Previous Archaeological Research In the Chief Joseph Dam Project Area

Campbell (1983) recently outlined the history of archaeological research in the Rufus Woods Lake area, giving special emphasis to changes in the perspective taken by the sequence of researchers. Rather than repeat that excellent effort here, we have summarized previous research in a table listing reports on previous research, the study areas, purpose of the undertaking and numbers of sites found, tested or excavated. Several of these projects included sites which we tested; details are presented in individual site reports (Appendix A). What follows is a brief synopsis (see Table 3).

In 1949 and 1950, Douglas Osborne supervised students from Washington State College and the University of Washington conducted a survey of the north bank of then-proposed Rufus Woods Lake. They located 20 sites, most of them late period housepit clusters situated on low river bars (e.g., 45OK6, in the project area). After his personnel had conducted test excavations at 10 sites, Osborne (1952) concluded that little time depth or change in local culture was in evidence.

Except for Garner's (1956) burial relocation efforts, the area was ignored until a second set of federally sponsored inventory and testing projects was conducted in 1969, 1970 and 1975 by Washington State University (Bryant et al 1975; Leonhardy 1970; Lyman 1976). In 1969 and 1976 the Columbia River's south shore was surveyed for the first time and sites recorded by Osborne were reinspected. Fifty-one new sites were recorded but with lower floodplain areas under water, many of the sites were on upper terrace levels. Comparing his observations with artifact assemblages collected from the Kettle Falls, Snake River and mid-Columbia sub-areas, Leonhardy (1970) concluded that archaeological cultures in northern and central/southern portions of the Plateau appeared to be quite different from each other. In addition to site inventory, Lyman (1976) tested three sites (45OK6 among them) and salvaged one eroding housepit at 45OK5. He concluded that 45OK6 (including sites 45OK196 and 45OK197 of our project) was merely a secondary deposit eroded from 45OK165, above. (In fact, by that time, the 45OK6 of record was beneath the gravel berm produced during construction of the third powerhouse at Grand Coulee Dam. Aerial photographs taken in 1930 show a cluster of up to 20 housepit depressions at that location; it is evident that Lyman was testing another site.) In his excavation of a 1000-year-old house at 45OK5, Lyman observed that the dwelling (one of four then visible at the site) had been occupied at least three times.

Next began the series of inventories, testing and excavation projects motivated by a 10 foot raise of the Rufus Woods Reservoir and operation of the third powerhouse at Grand Coulee Dam. Seattle District Corps of Engineers archaeologists first conducted an inventory of the reservoir area, locating over 200 sites and estimating that the reservoir contained up to 400 sites (Munsell and Salo, 1977). Included in their inventory were sites 45DO189, 190 and 191 and 45OK193, 194, 196, 197, 198, 199, 205, 207 and 219. In 1977, the Chief Joseph Dam Cultural Resources Project (CJDCRP) began, conducted by the University

Table 3. Previous Archaeological Investigations in the Chief Joseph Project Area.

Reference			Numbers of Sites Survey[1]	Testing	Excavation
Osborne 1949	Rufus Woods Lake	Site Inventory, River Basin Survey	20	11	
Osborne et al. 1952	Rufus Woods Lake	Test Excavations at 10 sites		10	
Garner 1956	Rufus Woods Lake	Relocate Burials			1
Leonhardy 1970	Rufus Woods Lake	Inventory South Shore, Reinspect Previously Recorded Sites	17		
Sprague & Birkby 1973	Rufus Woods Lake	Relocated Burials			1
Bryant, Leonhardy and Lyman 1975	RM 590-597	Inventory South Shore, Reinspect Previously Recorded Sites			
Lyman 1976	Rufus Woods Lake	Test Excavations, Inventory of Sites	34	3	1
Munsell & Salo 1977	Rufus Woods Lake	Inventory of Sites to be Affected by 10 ft. Pool Raise	206		
Bryant 1978	RM 590-597	Test Excavation and Evaluation of Sites in Bureau of Reclamation Jurisdiction, Determine Effects of 3rd Grand Coulee Powerhouse		3	
Sprague & Mulinski 1979	Rufus Woods Lake	Burial Relocation			2
Leeds et al. 1980	RM 590-597	Inventory for WRPS Downstream Bank Stabilization	23		
Jermann et al. n.d.	Rufus Woods Lake	Reconnaissance and Test Excavations of 78 Sites, Evaluate and Place in Settlement Patterns for Area	43	78	
U of W Members of OPA Staff	Rufus Woods Lake	Salvage Excavations at 18 Sites Ranging from 6000-100 BP			18
USCE, USBR Staff	Rufus Woods Lake	Preliminary Tests of RM 590 Sites		10	

[1] Lists only those sites newly recorded during each investigation.

of Washington Office of Public Archaeology (OPA). That same year, Prolysts, Inc. of Eugene, Oregon investigated sites above RM 590 for the Bureau of Reclamation (Bryant 1978). Their work primarily consisted of a resurvey of known sites; test excavations at sites 45DO189, 190 and 191; an assessment of potential significance; and an evaluation of potential impacts from the tailwaters of the third powerhouse at Grand Coulee Dam.

The CJDCRP is by far the largest scale cultural resources project ever undertaken on the Columbia Plateau. It tested 79 sites and is completing analysis and reporting on excavations at 18 of those sites (Jaehnig 1983). Leeds et al. (1981), reporting on the test excavations alone, concluded that there had been very little change in people's use of the riverine environment during the 6000 years represented by their sites.

Because there are not yet any final reports for the CJDCRP, statements we make about the content and geology of CJDCRP sites are based on 1) preliminary tables describing stratigraphy and the faunal inventories of some of those sites and 2) data presented at the 1983 Northwest Anthropological Conference, CJDCRP Symposium.

A small-scale site inventory was conducted by OPA in the same area investigated by Prolyst (Leeds et al. 1980). Site 45DO12M was recorded at that time. Continued monitoring of the reservoir's banks by Mr. Larry Fredin, representing the CCT, has led to more site discoveries, including 45OK394.

In the spring of 1982, Corps of Engineers and Bureau of Reclamation personnel conducted minor test excavations at 10 sites in the Study Area, including 45DO12M, 45DO189, 45DO394, 45OK6, 45OK196, 45OK197, 45OK205, 45OK207 45OK208 and 45OK219. Although the results of these tests were not formally reported, we were provided with copies of all data.

Archaeological research in adjacent uplands has been minor, but the results have been significant. Osborne (1967) surveyed and tested in the Grand Coulee; the CCT did the same in the Mt. Tolman area (Jaehnig 1980), Eastern Washington University has surveyed powerline corridors emanating from the areas Dams for the Bonneville Power Administration (e.g., Meirendorf et al. 1981) and Central Washington University excavated several mesa-top sites in the channeled scablands (Smith 1977).

Conceptual Framework

We have approached the analysis, interpretation and evaluation of archaeological materials recovered at RM590 from the perspective of evolutionary human paleoecology: "the study of human behavioral evolution in terms of ecology and the theory of natural selection (Chatters 1982a:10)". This form of study seeks to use the paradigm of neo-Darwinian evolutionism in order to explain temporal variation in people's adaptive strategies and the changing relationship between those strategies and the biophysical environment. Archaeologically perceived changes in adaptive strategies, we suppose, are ultimately the result of differential reproductive success (either intellectual or biological reproduction; Richerson 1977; Richerson and Boyd 1979) among individuals living by alternative strategies. Differential success is the outcome of interaction between the cultural (organizational and technological) elements of an adaptive strategy and the biophysical environment. The selective pressures on competing individuals can be altered by several factors: innovations in technology; changes in task organization of the human populace; or the yearly temporal and spatial distribution of that populace and shifts in the geographic and seasonal distribution of those portions of the biophysical environment with which people customarily interact all can change. This in turn can shift the balance of reproductive success from people living by one adaptive strategy to those living by another.

An archaeological investigation based on evolutionary human paleoecology consists of two principal parts: 1) identification of a sequence of adaptive strategies for a study area and 2) identification of those environmental, technological and organizational variables that are most likely to have altered the selective advantage of competing strategies, leading to the event(s) noted in part 1.

To conduct such an investigation we require five sets of information from the archaeological record. First, we must identify the products of short-period site occupancy by social groups. These products are occupations (the set of artifacts left by a group of people over a continuous period of occupancy [Dunnell 1971; 1973] or more tactically defined, artifacts left by the smallest temporally distinguishable set of repeated visits [see Chatters, 1982]).

Second, occupations are dated so that only those belonging to a single time period are compared and information about adaptive strategy can be derived. Third, tool, feature and resource (flora, fauna, lithics) content of each occupation are analyzed and functional classes of occupations (settlement classes) are defined on the basis of these characteristics. Fourth, settlement patterns are formulated by observing the environmental and seasonal distribution of these settlement classes. Finally, we consider the diversity of assemblages in terms of tools, features and resource remains and observe the distribution of resource remains among various settlement classes. With this last bit of data, we can assess the season or seasons during which a class of settlement was occupied and determine whether or not the food gathering activities performed there or in the vicinity were opportunistic or selective.

Once these time-period constructs have been identified, they can be placed in temporal order so that a sequence of change in adaptive strategies is observed.

Here enters the evolutionary part of the analysis, the search for cause using the paradigm of neo-Darwinism, the isolation of those variables in the natural environment, technology and/or human, organization that altered selective pressures favoring one strategy over another. Selective pressure impinges on the human adaptive strategy through the niche, the combination of time, habitat and resources that constitutes an interface between people and their biophysical environment. Given a constant technology, social organization and a stable environment, human beings will evolve an optimal adaptive strategy. In the absence of change in any of these variables, a strategy will have considerable longevity. If technology, organization or the biophysical environment changes, the human/environment relationship may be upset, altering the balance between people and those portions of the environment with which they interact (effective environment) thus effecting selection pressure for adaptive reorganization.

To identify these selective pressures, or more properly those variables that alter selective pressures, requires 1) an understanding of the human habitat, seasonal distribution and resource utilization such that we can identify those portions of the environment that are most important to people; 2) identification of new modes of human organization or new technologies for acquiring, processing, transporting, and storing resources through an analysis of features, tools and their environmental distributions within and among various occupation areas; 3) paleoenvironmental reconstruction that is diachronic in its focus to identify changes in people's effective environments and 4) creation of a plausible link between changes in the niche and either changing technology, organization or environment.

<u>Procedural Details</u>.

Analysis of RM590 data followed this structure. We began by identifying occupations in the sites, determined the age of each occupation , placed each occupation into a "functional" class of settlement using features, use wear classes of lithic tools and faunal remains, sought information about seasonality of site occupancy and

(settlement patterns). With these established, we considered the diversity of faunal remains and tools present in each settlement type and the degree of inter-assemblage variability among occupations of the same time period and thereby obtained preliminary ideas about the nature of prehistoric adaptive strategies in the study area. From faunal remains and settlement distributions we also obtained data on the use of resources and, therefore gained insight into the portions of the environment most important to local people and from which the forces of selection would impinge upon them.

Our excavations were insufficiently extensive for us to obtain detailed data on the organization of the Study Area's former human occupants. However, comparing our data with information obtained by archaeological investigators before the reservoir was filled, we were able to discern changes in the degree of nucleation among residential base-camp communities. Technological data came from a study of features.

Paleoenvironmental reconstruction was accomplished with data from both the study area and the region. Local data was limited to the sedimentary sequence of our archaeological sites, but regional sources included numerous pollen records from Washington (including a pollen core from nearby Goose Lake, in the Omak Trench), British Columbia and northern Idaho, geologic investigations on the Snake and Columbia Rivers and the glacial and paleotemperature records for northern North America.

This report is structured such that, after a presentation of data recovery techniques, each set of analytical procedures is followed immediately by its results. Thus this report is divided into parts, covering Data Recovery, Occupation Identification and Chronology, Settlement and Subsistence Patterns, Adaptive Strategies and Paleoenvironments. Relationships between human adaptation and environmental change will be included in the final chapter (XII).

Scope of Analysis, Source of Conclusions.

This study is based on test excavation of 15 prehistoric archaeological sites along a two-mile stretch of the Columbia River. No site is greater than a few hundred meters from the river, nor are any of the sites in an upland environmental setting. In addition to this geographic limitation, the number of artifacts obtained from each site is small. Therefore, it would be a mistake for us or the reader to assume that a complete study of adaptive change could be adequately accomplished with such a restricted data base.

We are, of course, not working in a vacuum. A large body of data on Plateau prehistory exists, including results of excavations and surveys in both upland and riverine environments. The data sample from RM590 is but one more data set among many which, in the last chapter of this report are combined into a revised outline of prehistory for the central Columbia Plateau.

None of our statements, whether about local settlement patterns, regional paleoenvironments or Plateau prehistory should be taken as conclusory. What we have endeavored to do, with a small body of data viewed in regional context, is to generate a series of hypotheses that we and hopefully others will utilize as a framework for future research.

CHAPTER II

DATA RECOVERY PROCEDURES

Data recovery procedures employed at RM 590 were designed to determine the number, horizontal extent and condition of occupation zones at each site. Where discrete occupations were discernable, we attempted to obtain enough artifacts and records from each so that it could be incorporated into our analysis of adaptive strategies.

This chapter presents the general approach taken by the project; procedural details can be found in individual site reports (Appendix A).

Test Excavation

Site testing was a two-phase process. The first phase ("Preliminary Testing") was designed to acquire information on the number, extent and integrity of cultural occupations at each site. Following preliminary testing, those sites which CWAS and COE Archaeologists determined to be intact enough for temporal and subsistence-settlement system assignment were further investigated through "Localized Testing". This latter phase was conducted when preliminary tests had not obtained large enough quantities of artifacts and feature records for the site's information potential to be evaluated. Criteria used to decide whether to pursue Localized Testing are discussed along with other procedures used in that phase of testing.

Preliminary Testing.

Before testing began, CWAS Archaeologists toured the project area with Mr. Jonathan Maas, Staff Archaeologist, Seattle District COE. With the aid of District file maps, Mr. Maas showed us the location of each archaeological site and pointed out its horizontal limits as estimated by its discoverers. At this time we noted three apparent discrepancies between recorded site locations and surface distributions of artifacts (Table 2). Site 45OK165 covers approximately twice the recorded area; 45OK194 contained only a group of burial cairns and none of the mussel shell and fire broken rock reported on the site survey form. As a result of these observations, burial site 45OK194 was removed from our list of sites to be tested and was replaced with the newly observed portions of 45OK165. No surface artifacts or features, other than 20th century trash and a house foundation could be found at the reported location of 45OK198, but we proceeded to test the erroneously located 45OK198, as directed. After completing our tests, we learned that 45OK198 had been incorrectly located on the maps issued to CWAS.

Datum Points. A permanent datum was implanted once a site's approximate area had been determined. Markers consisted of 50cm sections of 4 inch plastic tubing filled with concrete with a section of steel reinforcing bar in the center. Site numbers were impressed in the soft cement and, once dry, the data markers were buried with the marked end flush with the soil surface.

Test Unit Placement. A grid was then laid out over each site, such that ~~it covered an area~~ slightly larger than the suspected site boundaries (Figure 6). Site areas were estimated using COE supplied maps, field observation of surface artifact distributions and the inspection of cut bank exposures. Where cut banks lacked fresh exposures and slumpage and vegetation obscured visibility of cultural deposits, excavators faced up the banks at intervals of less than 20m. Grid intervals were 10 or 15m, with the decision of interval based on site size and the predicted density of artifacts. In larger sites, adequate amounts of material could be expected from a 15m grid simply because the number of pits excavated into the site would be larger and the volume of cultural layers observed would be proportionately greater. Site density has been shown to be an important factor when small test pits are utilized. The lower the artifact density, the smaller is our chance of accurately reporting the area covered by a particular site (Lynch 1980; McManamon n.d.). Lynch (1980) has demonstrated that a smaller testing interval increases the accuracy of site area estimation when artifact density is low. Hence we used the smaller 10m grid when low artifact densities seemed likely and for when sites were small.

We deviated from this general approach in two situations: in narrow, linear sites situated on low-lying interfan terraces; and at sites confined to tiny terrace remnants, where site area was coterminous with available land surface. Linear sites were tested by placing test pits at intervals of 15m or less (for reasons noted above) on their long axis. On terrace remnants narrower than 15m, we placed our test pits purposively in the manner described below as Localized Testing.

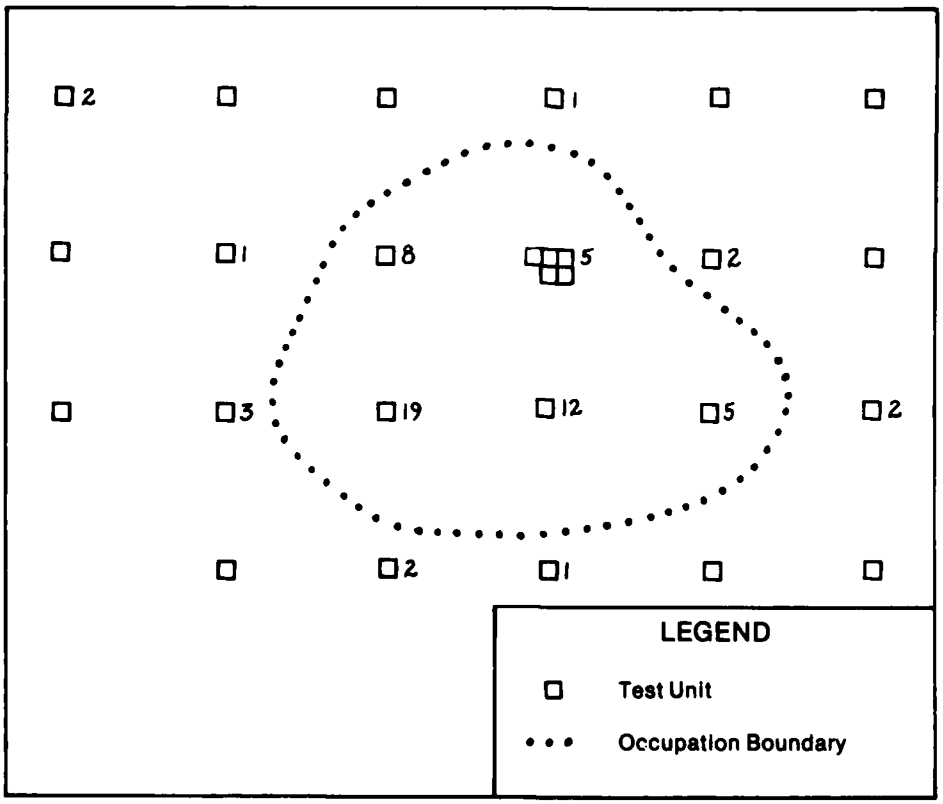


Figure 6. Examples of procedure used to estimate occupation boundaries. Numbers represent items in one artifact category (e.g., flakes).

Test Unit Size. Test pit sizes varied from 50cm squares to 1x2m rectangular units, with the choice of pit size dependent on estimates of deposit depth and degree of sediment consolidation. Pit size was proportional to deposit depth and inversely proportional to consolidation. Reasons are practicality and safety. A narrow pit cannot be efficiently excavated below 1.5m in depth and pit stratigraphy becomes difficult to read below this depth. One meter or 1x2m squares provided for speedier excavation and better observation of site stratigraphy. In soft, sandy sediments expected to be over 2m in depth, we usually used 1x2m pits to reduce the danger of cave-ins. Table 4 summarizes excavation procedures used at each site.

Arbitrary Levels. In all cases but one (45OK207) test pits were excavated in 20cm arbitrary levels. We chose 20cm levels in the interest of economy.

Smaller (10cm) vertical units were employed at 45OK207 because we hoped to distinguish thin floor layers in 3 house pits visible at the modern surface. As it was, rodent smear and anthropogenic disturbance were so severe here as to effectively preclude precise distinction of house floor deposits. Each floor deposit was 20cm or more in thickness after 4000 years of bioturbation.

Artifact Collection. The largest data and artifact collection unit utilized was the 1m grid square. Soil matrix was screened through 1/4-inch mesh and all ground and chipped stone, bone fragments, and mussel shells retaining some portion of the hinge were saved for later analysis. Fire broken rocks were counted, weighed and discarded in the field. Features, including dense concentration of charcoal, stones, mussel shell, tools or combinations of these materials were carefully cleaned, mapped and photographed. Artifacts found in features were retained by feature rather than by arbitrary level. In larger features, such as house floors, 1m grid coordinates also were recorded for feature contents. Artifacts were mapped in situ, where possible, but features and 50cm or 1m grid squares were the usual collection units. Samples of approximately 1-liter volume were collected from each stratigraphically discernable cultural layer or feature in each grid unit and these were saved for flotation to collect charred plant fragments. Charcoal was also collected, when found, and stored in foil or plastic containers for possible submission to the Radiocarbon Dating Laboratory.

Profiles. Stratigraphers drew one or more walls from each of at least three test pits at each site where stratigraphy was not homogeneous, recording color, texture, compactness and boundaries for each stratum. Samples were saved from each stratum in at least one pit at each site. Where stratigraphic variation among three pits was too great to allow for accurate cross-dating of sediments, more pits were profiled (this decision was made by the Principal Investigator). Where light and pit size permitted (50cm pits could not be easily photographed) example profiles were photographed. Profiles and photographs also were used to record natural and artificial bank exposures.

Localized Test Excavation.

Goals. When preliminary tests failed to produce a large enough sample of artifacts, stratigraphic information, or feature data for us to effectively evaluate a site's information potential, we conducted this second phase of testing. After preliminary testing, it was clear that one or more discrete occupations could be discerned at 45OK165, 45OK196, 45OK208, 45OK219, 45DO189, 45DO190/191 and 45DO394. Larger samples of artifacts were obtained from these sites by purposively locating test units. In addition, there were other reasons for localized testing at 45OK207, 45DO190/191 and in part at 45DO189: surface-apparent site structure and subsurface structure indicated by the proton magnetometer survey.

Table 4. Summary of RM 590 Preliminary Testing Procedures.

Site	Estimated Area (m^2) [1]	Estimated Percent Excavated [2]	Surface Artifacts	Bank Exposure	Bank Facings	Grid Size in Meters	Pit size & No. 50cm	1m	1x2m	Total Volume Tested
45DO189	400	5.2	Few	Extensive	Unnecessary	10		7		9
45DO190/191	1500	1.5	+	+[3]		10		20		31.5
45DO394	380	3.6	Few	Extensive	5	Purposive			4	
45DO12M	200?	1.0	-	Extensive	Unnecessary	10		2		3.2
45OK165	2000	0.7	+	+	4	15	7	12		22
45OK193	400	0.5	Few	-		15	8			2
45OK198	4000	N.A.	-	+[3]		15	9			1
45OK199	100	1.5	+	+[3]		Purposive	2	1		2
45OK205	900	0.9	+	-		15	7	6		7
45OK207	1000	2.3	+	+		10 (Purposive)			5	15
45OK208	1000	2.8	+	+[3]		15	15	8		12
45OK219	5000	0.3	+	+[3]		15	15	10		19

[1] Based on field observations and COE estimates

[2] Based on area excavated/total area, both phases

[3] Eroding terrace edge, primarily a sloping, deflated surface, not conducive to facing but provided information on site extent in one or more dimensions

45OK207 is on a small remnant of the T2 Terrace and has three large, distinct housepit depressions. Surface artifacts clearly were concentrated near the depressions in several areas, while few or no artifacts were evident elsewhere. Thus, we were aware from the outset of the strong patterning of activities at this site. Preliminary testing to ~~determine site boundaries was unnecessary;~~ most tests placed here were purposively chosen to investigate particular portions of the artifact and feature pattern.

Localized testing also was used to provide data for evaluating the utility of proton magnetometer survey for locating subsurface features at 45DO189, 45DO190/191 and 45OK207 which were chosen as test cases for this technique. Briefly, the technique measures intensity of magnetic field at points on the ground surface and compares that intensity with the overall magnetic field of the earth. Deviations from the earth's field are recorded as positive and negative anomalies. By taking a series of magnetometer measurements from a large, gridded area, one can produce a map of magnetic anomalies closely resembling a contour map. Human activity can result in the production of magnetic anomalies, either positive or negative, and the analyst uses this fact to identify certain anomaly patterns as cultural features.

Robert Huggins of Spectrum Geophysics, Fort Worth, Texas, conducted our magnetometer surveys and provided us with maps of anomalies he thought to be cultural (hearths, piles of trash, and house floors, were possibilities). Some of our localized test pits were excavated into areas showing such anomalies to determine what exactly was being measured by the instrument. Huggins' report is included as Appendix B, and a more detailed account of the procedure and its results can be found therein.

Table 5. Reasons for Localized Test Excavations at RM 590 Sites.

Site	More Data	Site Structure & Size Already Clear	Test Proton Mag.	Artifacts & Features	House Size & Extent	Test Magnetic Anomalies	Total #	Total Vol., m^3
45DO189	+		+	2	8	4	14	12.2
45DO190/ 191			+			3	3	4.5
45DO394	+			4			4	6.0
45OK207		+	+	(10)*	9	8	13	28.0
45OK208	+		23	16			16	33

* Included in Table 5 as Preliminary Tests, this figure is excluded from row totals

Technique. Test excavation techniques during this phase were little different from those used for preliminary tests. The primary difference here was that vertical collection units were either natural stratigraphic layers (areas of 45OK208) or, where these could not be distinguished, 10cm arbitrary levels. In addition, excavators drew plan maps showing the distribution of artifacts found in situ on each stratum surface or at the base of each 10cm level.

Horizontal units were either 1x2m pits or clustered groups of 1m squares. As before, the largest data and artifact collection unit was the 1m square.

Choice of Test Units. Reasons for choosing localized test units are at least as diverse as the purposes for this phase in our investigation. For the most part, however, test pits were placed either 1) in areas of high artifact concentration or where cultural features or undisturbed occupation layers had been found in test pits, 2) to cross-section pit house depressions and determine the size and profile of the pit excavations,and 3) to investigate magnetic anomalies. Reasons for test unit choice and the number of 1x1m units excavated for each reason are presented in Table 5).

Mechanical Trenching.

In our case, a backhoe was used at 45OK208, to investigate the unusual stratigraphy of the site and learn about the formation of the T2 terrace level.

CHAPTER III

IDENTIFICATION OF OCCUPATIONS

Discerning Occupations.

Beneath the surface of a site lay one or more layers of artifacts, features and occupation debris (e.g., bone bits, charcoal, organic stains, fire broken rock) left by human beings who continuously or discontinuously occupied temporarily stable land surfaces. Unless a layer lies at the present land surface, as do many, it has been buried by water, wind or land-slide deposited sediments and a new, higher surface has developed for later habitation. Subsequent to burial, this artifact bearing layer or occupation zone has been subjected to various kinds of disturbance by rodents, insects, plant roots, rainfall, frost action and later human occupants of the same site. The result in most fine, sandy soils is that occupations rarely appear as distinct artifact bearing strata.

Our tasks at this stage of analysis are (1) to determine to the best of our ability how many occupations exist at a site and (2) to determine the depth and horizontal extent of each. To achieve the first goal we applied two techniques, usually in conjunction: plotting the vertical distributions of all artifacts and observing the vertical distributions of chronologically meaningful artifact classes, primarily projectile points.

The technique of identifying occupation zones by plotting vertical distributions is based on the vertical smear concept of artifact distributions in sandy, easily disturbed soil. We have observed that a single occupation comprised of artifacts deposited on a once stable surface will exhibit a curvilinear distribution of artifact frequencies with depth (cf. Wilmsen 1974). This distribution is usually skewed, with the tail of the curve extending either above or below the occuation, depending on the degree of soil compaction and degre of bioturbation above and below the original occupation surface. We assume that, where artifact frequencies exhibit a curvilinear distribution with depth, the mode of this curve should identify the layer on which human occupation has occurred. Where two or more modes are observed in the frequency curve, an equal number of archaeological occupations can be assumed to exist. In a bimodal curve, such as that shown in the hypothetical example (Figure 7), the dividing line between artifacts attributable to each occupation is the low point between modes (point A in Figure 7). All artifacts from above this low point are assigned to the upper occupation (Occupation One), those below to the lower occupation (Occupation Two). For each horizontal excavation unit (test pit or 1x1m block) the vertical distribution plot and resultant, analytically-defined occupations are then compared against the stratigraphic profile for that unit to determine the stratigraphic position of each occupation.

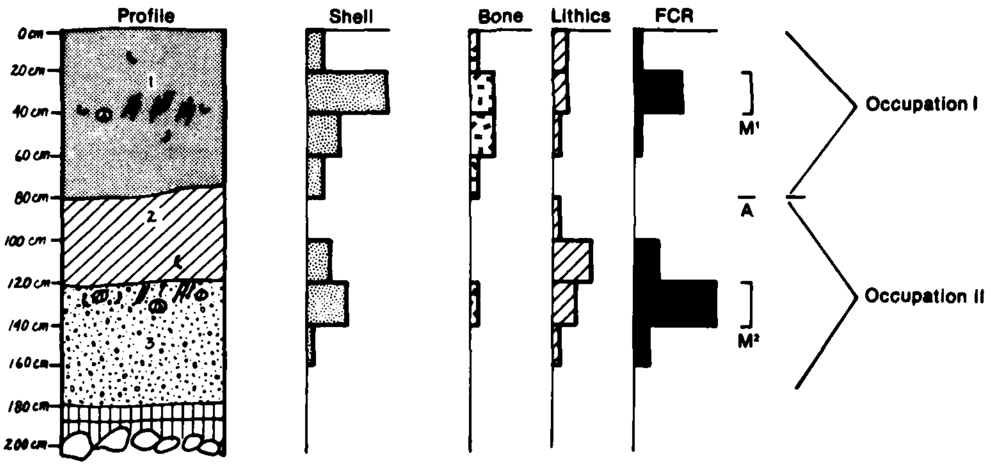


Figure 7. Idealized display of artifact frequencies, plotted by depth, compared against the profile of a hypothetical test pit.

In the hypothetical example (Figure 7) vertical frequency plots of shell, bone fragments, lithics (chipped stone) and fire broken rock (FCR) in one excavation unit are compared with a profile from the same unit in which artifacts and organic staining can be distinctly seen at two levels. Vertical frequency plots exhibit the pattern we most commonly observed when such distinct artifact-bearing layers could be seen. Modes of shell and FCR coincide in depth with the organically stained stratum while modes for flakes were usually one arbitrary level above the stained layer and bone showed a less distinct tendency for modality. In this example, occupation strata are at 20-40cm and 120-140cm (M1 and M2). Artifacts assigned to Occupation One for analytic purposes are all those above 80cm. Those assigned to Occupation Two are below that depth. This procedure was followed with each excavation unit from each site. Often, where low points between modes weren't much lower in frequency than the modes themselves, artifacts between modes could not be assigned to an occupation. These residuals formed an "unassigned" artifact category.

Table 6. RM 590 Occupations.

Site	Occupation	Means of Identification	Area	Excavated Area	Excavated Volume
45DO12M	None				
45DO189	I	Vertical distribution, artifact style	400.00m^2	21.0m^2	14.20
45DO190/191	I	Vertical distribution,	780.60m^2	9.0m^2	11.00
	II	Artifact style	387.83m^2	6.0m^2	7.80
	III		293.78m^2	5.0m^2	4.80
45DO394	I	Vertical distribution	384.00m^2	6.0m^2	3.40
	II		337.64m^2	4.0m^2	4.40
	III		337.64m^2	4.0m^2	2.60
	IV		271.92m^2	8.0m^2	5.40
	V		58.64m^2	4.0m^2	2.20
45OK165	I	Vertical distribution, artifact style	2000.00m^2	14.0m^2	29.50
45OK193	None				
45OK198	None				
45OK199	I	Vertical distribution	100.00m^2	0.0m^2	4.40
45OK205	I	Vertical distribution	590.63m^2	8.0m^2	8.90
45OK207	I		1000.00m^2	23.0m^2	5.90
	II	Artifact style	1000.00m^2	23.0m^2	23.90
45OK208	I		113.53m^2	24.25m^2	3.50
	II	Artifact style	734.89m^2	45.75m^2	23.40
45OK219	I	Vertical distribution, artifact style	5000.00m^2	19.0m^2	3.00
	II		5000.00m^2	19.0m^2	11.20
	III		5000.00m^2	19.0m^2	1.40

In some cases, vertical frequency distributions were unimodal, but projectile point styles and/or radiocarbon dates were disparate enough to suggest that more than one time period was represented by the artifact assemblage. When this occurred we plotted the vertical frequencies of projectile point styles and the depth of radiocarbon samples. If projectile point styles showed a strong tendency for clustering with depth and/or if the Carbon 14 dates showed a similar clustering, then the occupations were clearly distinguishable by their different depths below surface. This approach usually resulted in a rather larger "mixed" assemblage where projectile points indicated over 30% overlap between occupations. Only with 45OK207 and 45OK208 was this kind of analysis necessary.

Horizontal Distribution of Occupations. This step entailed simply plotting the quantity of each general artifact class (shell, non-rodent bone, lithics, FCR) from each occupation in each 1m square test unit. Units with densities of over three objects of any category were treated as inside the area covered by the occupation. Occupation boundaries then were drawn by interpolation (Figure 6).

Results. Twenty occupations were identified from RM 590 sites (Table 6).

CHAPTER IV

RADIOCARBON DATING

Occupations in the RM 590 study were dated using a combination of radiocarbon, geochronological and cultural dating methods. In the following chapters, each method is discussed along with the results of its application. Chapter VII summarizes the results of all methods into a chronology of occupations.

Radiocarbon dates were obtained from as many occupations as sample availability would allow. In all, 12 of our 20 occupations were dated by this method (Table 7). For some occupations there were multiple dates. The eight undated occupations contained no concentrations of organic material in undisturbed context and thus, could not be dated.

All dates were obtained on either mussel shell (*Margaritifera falcata*) or wood charcoal, the latter being the preferred material. Dates based on carbon in mussel shell must be used with caution, for two reasons. First mollusk physiology leads to differential selection and use of the three isotopes of carbon (C12, 13 and 14), often incorporating disproportionate amounts of heavier isotopes (C13, 14; Ed Olson, personal communication 1983). The result can be a date either younger or older than the shell's actual age. We corrected for this problem by requesting Carbon 13/12 ratios for our shell samples and correcting accordingly.

The second problem is that mollusks obtain much of their carbon for shell growth from ground water. Ground water carbon may be derived from ancient calcareous rocks, such as limestones. Where groundwater (and ultimately river water) is rich in ancient inorganic carbonates, radiocarbon dates on shellfish living in that water can be several thousand years too old (Olson 1970). We could not correct for this problem, but were able to test for it by observing the stratigraphic consistency among charcoal and shell dates from single sites and by investigating the consistency between dates based on projectile point styles and/or geochronology and radiocarbon dates from the same occupation. Inconsistent shell dates were rejected. This occurred with only two samples (45DO394 III and 45DO190/191 I). One of these (45DO190/191 I) was also rejected at the suggestion of Dr. Murray Tamers of Beta Analytic, Inc. because the sample had an anomalously low Carbon 13 content compared with other samples from the study area. His technician had noticed an unacceptably high degree of exfoliation among laminae in individual shells, which could have resulted in an extensive amount of carbon exchange between the mussel shell and groundwater, thus producing an anomalous date.

All dates listed in Table 7 are based on the Libby half-life of 5568 years BP. We have presented a range of actual (dendrochronologically corrected) ages for each date following the work of Klein et al., (1982) who presented ages for radiocarbon samples within 95% confidence limits. To avoid the inevitable confusion that results from giving "actual" ages in years BP (before 1950) we have used the Gregorian calendar. Corrected ages are thus given in years AD or BC.

Table 7. Radiocarbon Dates From RM 590 Occupations.

Occupation	Provenience	Association	Material	14C Date Radiocarbon yr. BP[1]	Actual Age[2]	Beta No.	Consistent?
45DO189	20N/11W; 90-100cm	Housepit 1, floor	Charcoal	2960±80	885-1420 BC	5894	Yes
45DO190 I	5S/2E; 120-140cm	Housepit 2, floor	Charcoal	2500±90	400-820 BC	5892	Yes
45DO190 III	10S/10E; 220-240cm	Scattered	Mussel Shell	4630±110	3060-3655 BC	6263	ca. 500 yr. too old?
45DO191 I	80N/0W; 60-80cm	Shell feature	Mussel Shell	4590±90	3030-3645 BC	6264	No
45DO394 I	10N/8E; 60cm	Scattered	Charcoal	2740±70	790-1095 BC	5891	Yes
45DO394 II	2N/10E, 140-160cm	Scattered	Mussel Shell	4550±90	2990-3540 BC	6262	No
45DO394 IV	14N/19E; Stratum 9	Hearth	Charcoal	3548±90	1680-2180 BC	5893	Yes
45OK165 I	22S/105W, 104cm	Shallow pit feature	Charcoal	2270±50	175-525 BC	5256	Yes
45OK207 II	18S/2W, 130-140cm	House 1, floor #1	Mussel Shell	3950±70[3]	2130-2885 BC	5260	Yes
	21S/9E; 80-100cm	House 2, floor	Mussel Shell	4100±80	2405-2930 BC	6266	Yes
	24S/17W; 120-140cm	House 3, floor	Mussel Shell	4090±110	2400-2920 BC	6268	Yes
	28S/1W; 160-180cm	House 4, floor	Mussel Shell	4110±90	2410-2945 BC	6267	Yes
45OK208 I	22-24S/13W; 30-45cm	Earth oven	Charcoal	2380±120	195-780 BC	6562	Yes
45OK208 II	21S/17W; 50-60cm	Housepit 1, floor	Mussel Shell	4590±100	3030-3645 BC	5269	Yes
45OK210 II	45S/30E; 40-50cm	Shell feature	Mussel Shell	4760±120	3355-3790 BC	6265	Yes
	45S/15E; 150-160cm	Housepit 1, floor	Mussel Shell	4500±80	2640-3340 BC	5896	Yes

[1] Based on half-life of 5568 years

[2] From Klein et. al. 1982, Table 2, 95% confidence intervals

[3] No carbon 13/12 ratio obtained, date is uncorrected for isotopic fractionation

CHAPTER V

ARCHAEOLOGICAL CHRONOLOGY

The archaeological dating method we used was an amalgam of the index fossil approach and seriation. We relied primarily on projectile point style for chronological ordering, because chronologies for other artifact categories are either lacking for the area or are in the preliminary stages of development (e.g., the core tool chronology being developed for the CJDCRP by Lohse). The chronology we utilized was a temporary amalgam of Nelson's (1969) mid-Columbia sequence, Grabert's (1968) Wells Reservoir sequence and a preliminary typology devised by Lohse (1983b) for the CJDCRP. Lohse's typology, although incomplete at this writing, is based on the largest number of projectile points from dated occupations, is geographically closest to our own project area, and includes explicit, paradigmatic type definitions. We therefore based our analyses most heavily on his work. Style names used here were devised by Lohse.

We found the Lohse typology to be satisfactory with one exception. Lohse's type 5 (including all lanceolate projectile points, regardless of size) has too broad a temporal distribution to be useful as an historic type. Having observed distinct size groupings among our lanceolates, we investigated the relationship of projectile point size (length, width and weight) to the occupations radiocarbon age. Larger specimens are from older occupations at 45OK207, 208 and 219 (age range 4100-4700 BP) while smaller specimens are from Occupations One and Two at 45DO190/191 (ca. 3000 BP and younger). We treat these large and small groups as types 5 (large) and 5* (small). We recognize that our sample of points is very small and that, with larger numbers of artifacts, the simple time-size relationship noted here may be obliterated. However, we use this provisional distinction so that projectile point assemblages of disparate ages do not appear too much alike due to the use of types that are loosely defined.

In converting projectile point styles into dates, we use the seven period system outlined in Leeds et al (n.d.; Figure 8). Approximate period assignments of projectile point types are presented in Figure 8. This table is based on preliminary data from Lohse (1983b), along with data from Nelson (1969) and Grabert (1968); it is only a rough approximation, devised for use until Lohse's classification is completed. In general, large leaf-shaped points (Type 5) predate 4500 BP, large lanceolate sloping shouldered, stemmed points run from around 5000 BP to 3900 BP or later; traingular, stemmed, unbarbed forms (7-12) belong between 4500 and 2000 BP, large and small, triangular, barbed or stemmed forms postdate 2500 BP; and large side-notched types predate 4000; small forms postdate 1000 BP depending on size.

Table 8 presents the distribution of projectile point types among RM 590 sites. Based on this "seriation" the 14 occupations which contained projectile points are fitted into time periods of the CJDCRP. Examples of projectile points appear in Plates 2 and 3. Projectile

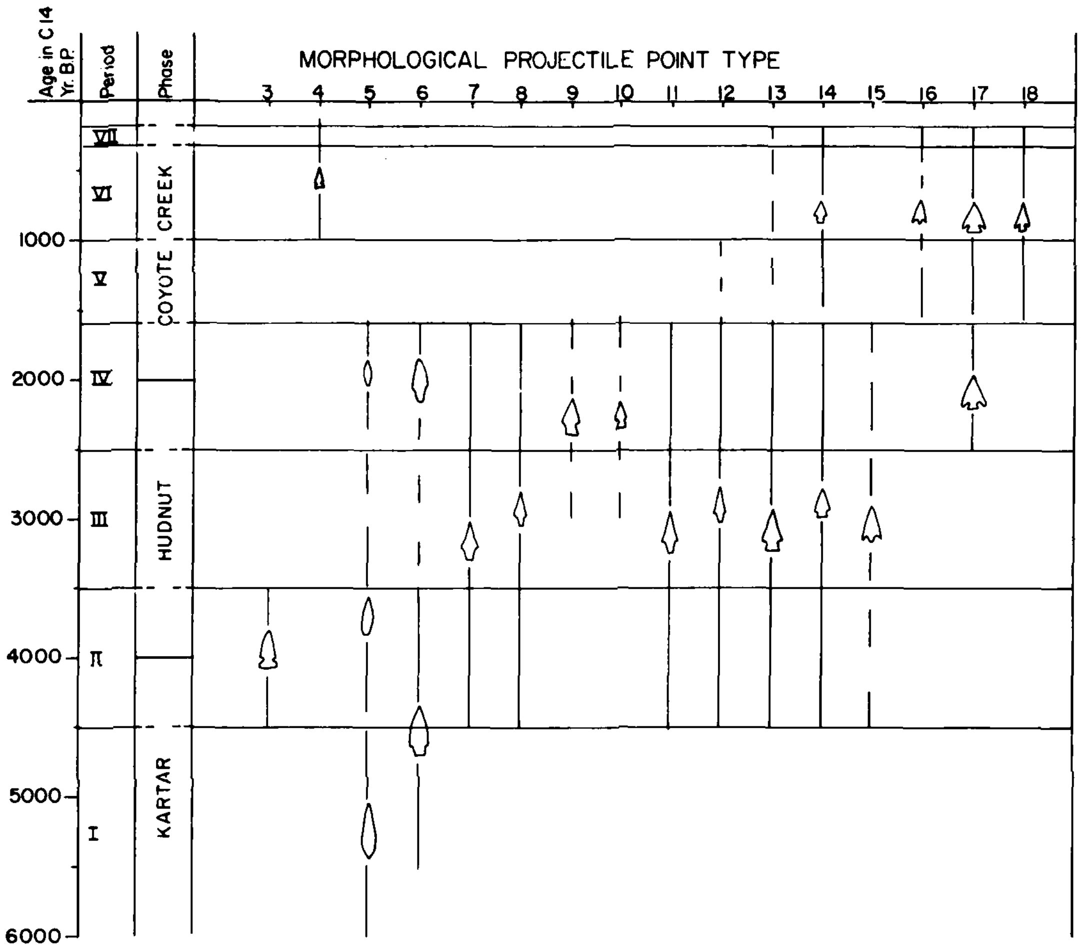


Figure 8. Chief Joseph area chronology, showing temporal distribution projectile point styles and Phases assigned by Jaehnig (1983). Data after Lohse 1983.

point measurements are listed in Appendix I.

Other Chronological Indicators.

There were few non-projectile point categories of artifacts that could be used in chronological placement of occupations. Nephrite adze blades, univalve harpoon points and microblade cores were absent from all occupations (including those postdating 1600 BP, not reported here). We did, however, find two kinds of items with demonstrated temporal meaning: microblades and small, discoidal beads of steatite and slate. Elsewhere in the CJDCRP, discoidal beads date predominately to late Period II and Period III (Jaehnig, personal communication) and when they occur in the central Columbia Plateau, microblades fall within the 4000-6000 year range (Munsell 1968; c.f., Chatters 1979). Discoid beads were found in Occupation Four at 45OK394, with an overlying occupation dating 3548+-90. We found microblades only in Occupation Two of 45OK208, dated 4590+-100 BP. In both cases, dates from beads or microblades are consistent with those based on projectile points and/or radiocarbon.

Table 8. Project point distribution from Project 590 site occupations using Lohse (1983). Classification specimens from a mixed arbitrary level at 45OK208 have been deleted.

	Projectile Point Types and Sub-Types[1]																							
	5		6			7		8					11			12			13			14	15	16	
Site & Occupation	A	B	A	B	C	A	E	A	B	C	D	E	A	B	C	A	B	C	A	B	C	B	A	B	Radiocarbon Years BP
45OK207[2]	1		1									1											1	1	
45OK165															1			1					1		2270 ± 50
45OK208 I								1			1		2	1											2380 ± 120
45DO190/ 191 I		3						1			1	1			1		1								
45OK219 I																					1				
45DO190/ 191 II		3					1	3	1	1				1	1				2	2	1				2500 ± 90
45DO394 III																			1						
45DO189														1		1	1				1				2960 ± 80
45DO394 IV																					1				3548 ± 90
45DO190/ 191 III														1		1									4630 ± 110
45OK207 II			1	2			1	1		1			1	2		1						1			$\bar{X}=4060 \pm 160$
45OK208 II		2		1	2																				4590 ± 100
45OK219 II			1	1																					$\bar{X}=4630 \pm 230$

[1] After Lohse, September 1983
[2] Mixed Component
[3] Small variant

Plate 2. Examples of projectile points from RM 590 sites, arranged by class including classes 5 (a-d), 6 (e-g), 8 (h-j) and 11 (1, k). Classes are arranged in approximate chronological order, bottom to top. Sources: 45OK208 II (a-c, e-f); 45OK208 I (i, 1); 45OK219 II (d); 45OK207 II (g); 45DO190/191 II (h, j, k). All actual size. Provenience as in the Table, below.

Item	Site	Unit	Depth	Artifact Cat. #
a.	45OK208	23S/18W	40cm	#8
b.	45OK208	14S/19W	20-30cm	#12
c.	45OK208	8S/24W	30-40cm	#6
d.	45OK219	4S/15E	80-100cm	#7
e.	45OK208	23S/18W	40cm	#4
f.	45OK208	1N/30W	30-40cm	#73
g.	45OK207	23S/16W	80-90cm	#82
h.	45DO190	5S/2E	120-140cm	#40
i.	45OK208	21S/18W	0-10cm	#15
j.	45DO191	80N/2W	140-160cm	#11
k.	45DO191	80N/2W	40-60cm	#6
l.	45OK208	21S/16W	50-60cm	#79

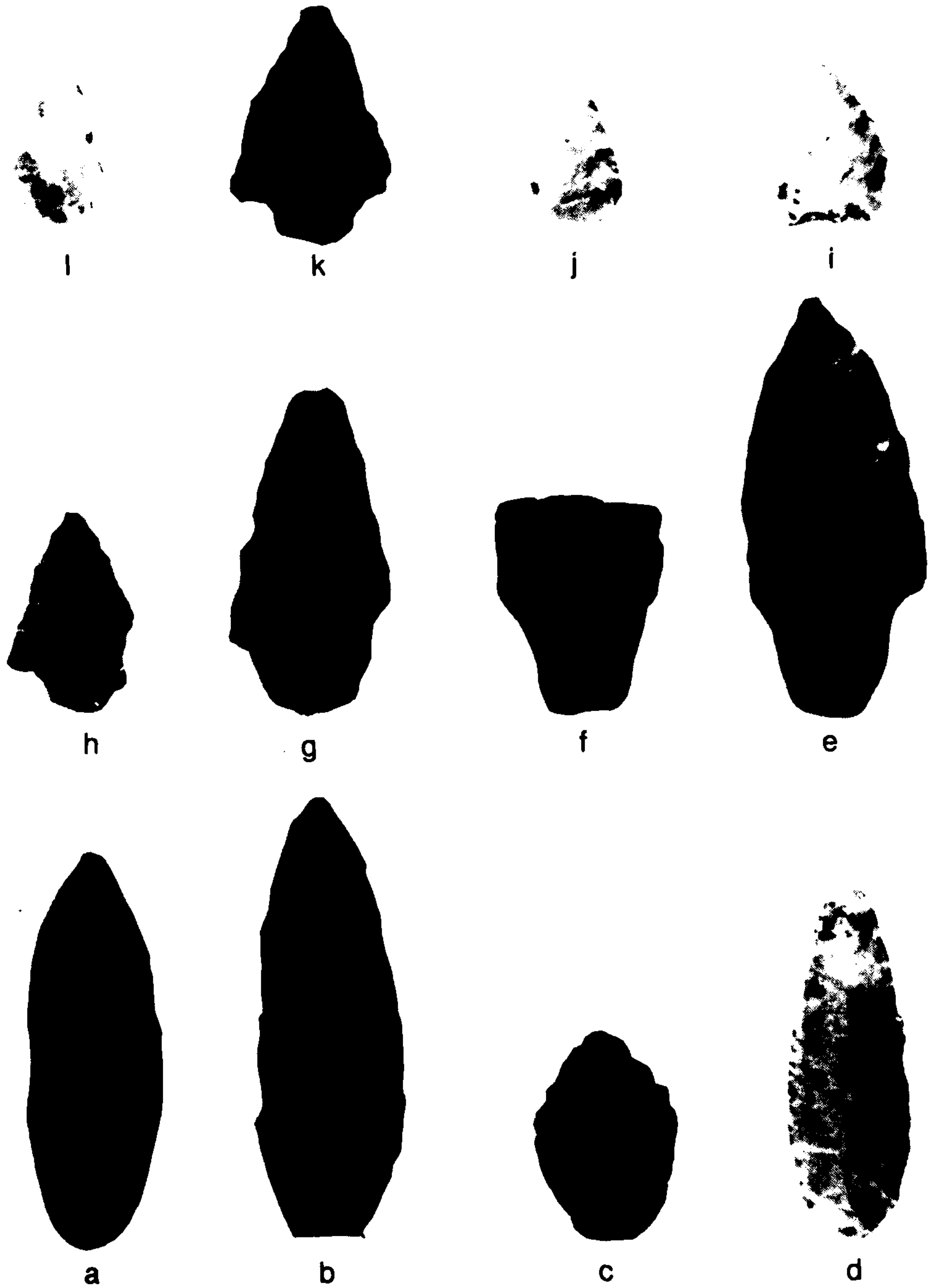
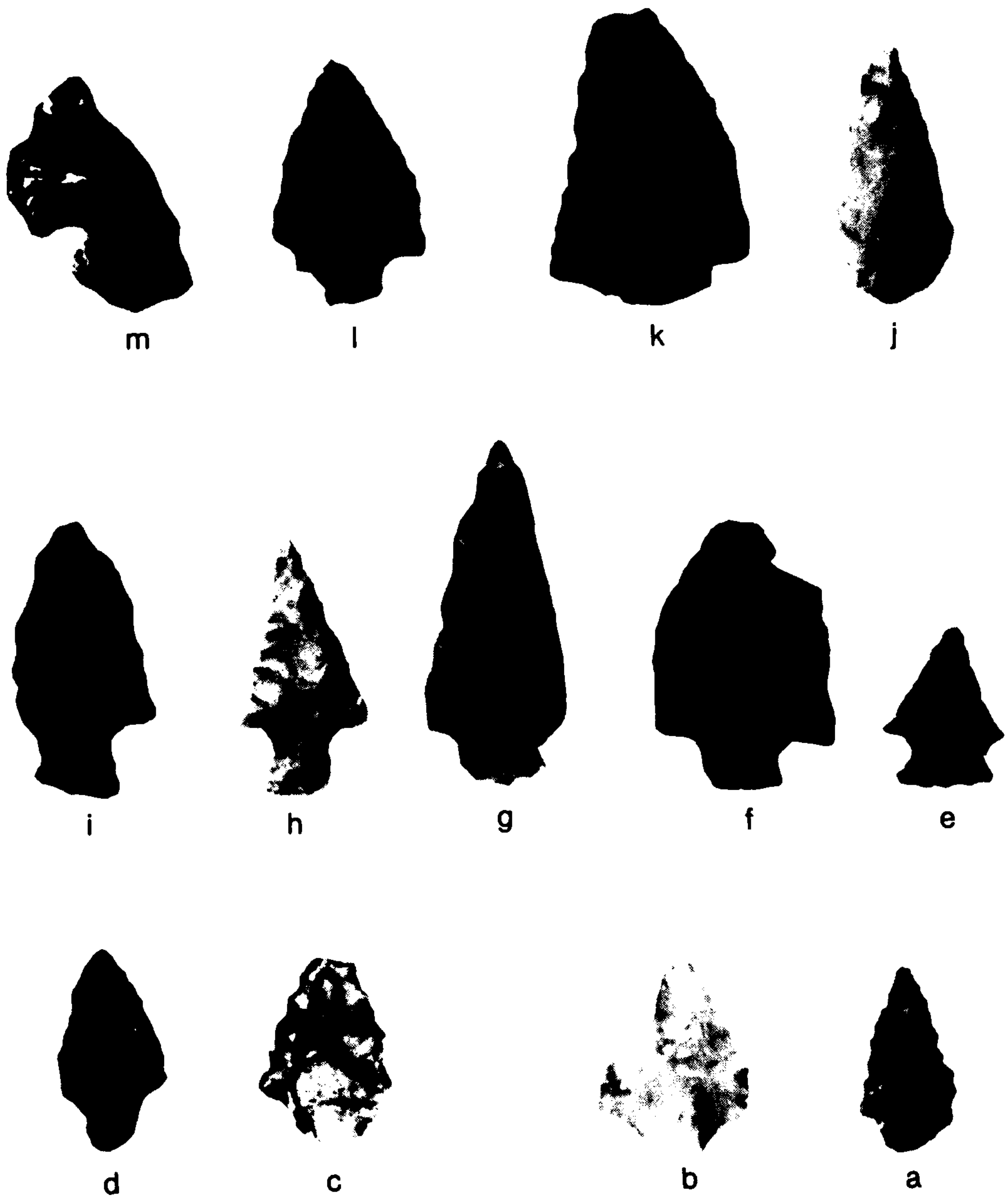

l
k
j
i
h
g
f
e
a
b
c
d

Plate 3. Examples of projectile point classes 7 (j), 11 (a, b), 12 (c, d), 12 (e-i), 15 (k, l) and 17 (m) from RM 590 sites. Classes are arranged in approximate chronological order, bottom to top. Sources: 45DO189 (c, d, g); 45DO190/191 I (f) and II (i); 45DO394 IV (e), 45OK207 I (k, m) and II (b), and 45OK208 I (a, j). All actual size. Provenience as in the Table below.

Item	Site	Unit	Depth	Artifact Cat. #
a.	45OK208	21S/12W	70-80cm	#84
b.	45OK207	23S/16W	90-100cm	#87
c.	45DO189	19N/10E	20-30cm	#4
d.	45DO189	13N/15W	0-20cm	#3
e.	45DO394	0N/1W	40-60cm	#7
f.	45DO190	5S/0W	120-140cm	#29
g.	45DO189	11N/20E	60-80cm	#5
h.	45OK219	45S/30E	0-20cm	#20
i.	45DO190	10N/0W	220-240cm	#15
j.	45OK208	22S/18W	40-50cm	#13
k.	45OK207	2S/2W	40-50cm	#101
l.	45OK208	22S/14W	20-30cm	#5
m.	45OK207	29S/1W	10-20cm	#16


m
l
k
j
i
h
g
f
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d
c
b
a

CHAPTER VI

GEOCHRONOLOGY AND SEDIMENTARY PROCESS

This chapter combines two sets of procedures and results from the investigation of stratigraphy at sites in the RM 590 study: the formulation of time-stratigraphic geologic units (temporally correlated sedimentary horizons) and the reconstruction of sedimentary process that led to geologic deposits where we find evidence of human occupation. The purpose of the first exercise is chronology; thus we are following on the radiocarbon and archaeological chronology chapters that precede this section. The second goal is paleoecological in its orientation and will form a basis for a summary of paleoenvironmental implications of the stratigraphic sequence.

Procedure

Our stratigraphic studies took four stages: 1) individual test pit profiling and description, 2) within-site cross-dating, 3) within terrace cross-dating and 4) between-terrace cross-dating.

Field descriptions of sediment color, texture, tephra layers, presence and kind of unconformities and buried soils and the kind and degree of disturbance were compared with the stratigraphic positions of dated occupations in each test unit from a site. In addition, samples of sediments from sites on the T2 and T3 levels (45DO189, 45OK165, 45OK219, 45OK207 and 45OK208) were submitted to Bruce Cochran of the University of Idaho for Mazama tephra content analysis (cf., Carlevato et al., 1982; Miss and Cochran 1982). Strata with disproportionately high Mazama tephra content (for the soil column of a single unit) or which lie above Mazama tephra-rich sediments are assumed to postdate 6700 BP. Strata low in Mazama tephra (again in proportion to other sediments in a single test unit) predate 6800 BP (see Appendix C). Tephra samples were identified using an electron microprobe (Smith, Okazaki and Knowles 1977) by Dr. Charles Knowles of the Idaho Bureau of Mines, Moscow (Appendix C).

Using this information and test unit profiles, we cross-dated among test units within each site to devise a site-wide schematic profile showing the most commonly occurring strata and their ages (if known, see Appendix A).

Using radiocarbon and time-stratigraphic (Mazama tephra) dating, along with bedding characteristics, color, texture, tephra content and stratigraphic position, we then cross-dated profiles from each terrace (Figures 10, 11, 12) and, finally, cross-dated between terraces to devise a sequence of time-stratigraphic geologic units (TS Units). Figure 9(a,b,c) presents the list of those units, with a key to profiles (Figures 10-12).

Results

Our test excavations in the RM 590 vicinity included sites on four terrace levels, T0 through T3. However, because work has not yet been completed at 45OK196 and 45OK197 the geology of T0 sites is not reported here. Of the remainder, four are on the T3 level (45OK165, 45OK193, 45OK198 and 45OK219), five on the T2 (45DO189, 45OK199, 45OK205, 45OK207 and 45OK208) and four on T1 (45DO12M, 45DO190, 45DO191 and 45DO394). Four of these sites (45DO12M, 45OK193, 45OK198 and 45OK199) contained either no cultural material or cultural material in quantities too small

Unit	Description
I	Undeformed, bedded, gray-brown glaciolacustrile silts and fine sands of the Nespelem Formation (Flint 1936).
II	Columbia River gravels of the T3 level.
III	Early Holocene fluvial and colluvial deposits overlying Unit II and deposited before renewed downcutting.
IIIa.	Medium to coarse, poorly sorted, distinctly bedded fluvial sands. These are magnetite-rich low-bar deposits.
IIIb.	Finely bedded, poorly to moderately well sorted sands and silts of fluvial and/or colluvial origin. Silts appear to have washed from exposed banks of Nespelem Formation material at the back of terraces.
IIIc.	Clastic flows of Nespelem Formation silts; slump and land-slide deposits from exposed silt banks.
IV	Columbia River gravels if the T2 level.
V	Fluvial and colluvial deposits overlying T2 gravels, deposited before renewed downcutting to the river's modern bed.
Va.	Same as Unit IIIa.
Vb.	Same as Unit IIIa.
Vc.	Same as Unit IIIc.
VI	Yellow brown and gray-brown, silty fine to medium aeolean sands. Deposits are moderately well-sorted and may represent reworked upper-bar fluvial deposits formed prior to downcutting below T2 and T3 levels. Occasionally this stratum includes coarse sands and small pebbles of colluvial origin.
VII	Light brown loess, loose and well sorted.

Figure 9(a). Time-Stratigraphic Unit Summary and Key to Figures 51-53.

VIII	Mazama tephra: dated 6700 BP.
IX	Light brown tephra-rich loess, loose to slightly compact and well sorted. Sometimes with varying amounts of colluvium represented as coarse sand and small pebbles.
a. b.	Soil 1. See discussion in text.
X	Columbia River gravels at the base of T1.
XIa.	Foreset beds and well-bedded low-bar deposits of poorly-sorted coarse to fine sands, beds are often magnetite-rich. Ranges in age between 4700 and 3500 BP.
XIb.	Silty fine sands deposited by the river in upper bar settings and subsequently reworked by winds. Deposition ceased around 2500 BP. There is often a minor colluvial admixture of pebbles and silts near the back edge terraces.
XIc.	Brown loess, slightly firm, deposited on T2 and T3, commonly combined near the back edges of terraces with small amounts of colluvium.
XId.	Colluvial flows of Nespelem Formation silts.
XII	Colluvial sands, silts and gravels postdating, but rarely overlying Unit XI.
XIV	Historic colluvium. Finely-bedded, water laid sands and silts.
	House Fill

Figure 9(b). Time-Stratigraphic Unit Summary and Key to Figures 51-53.

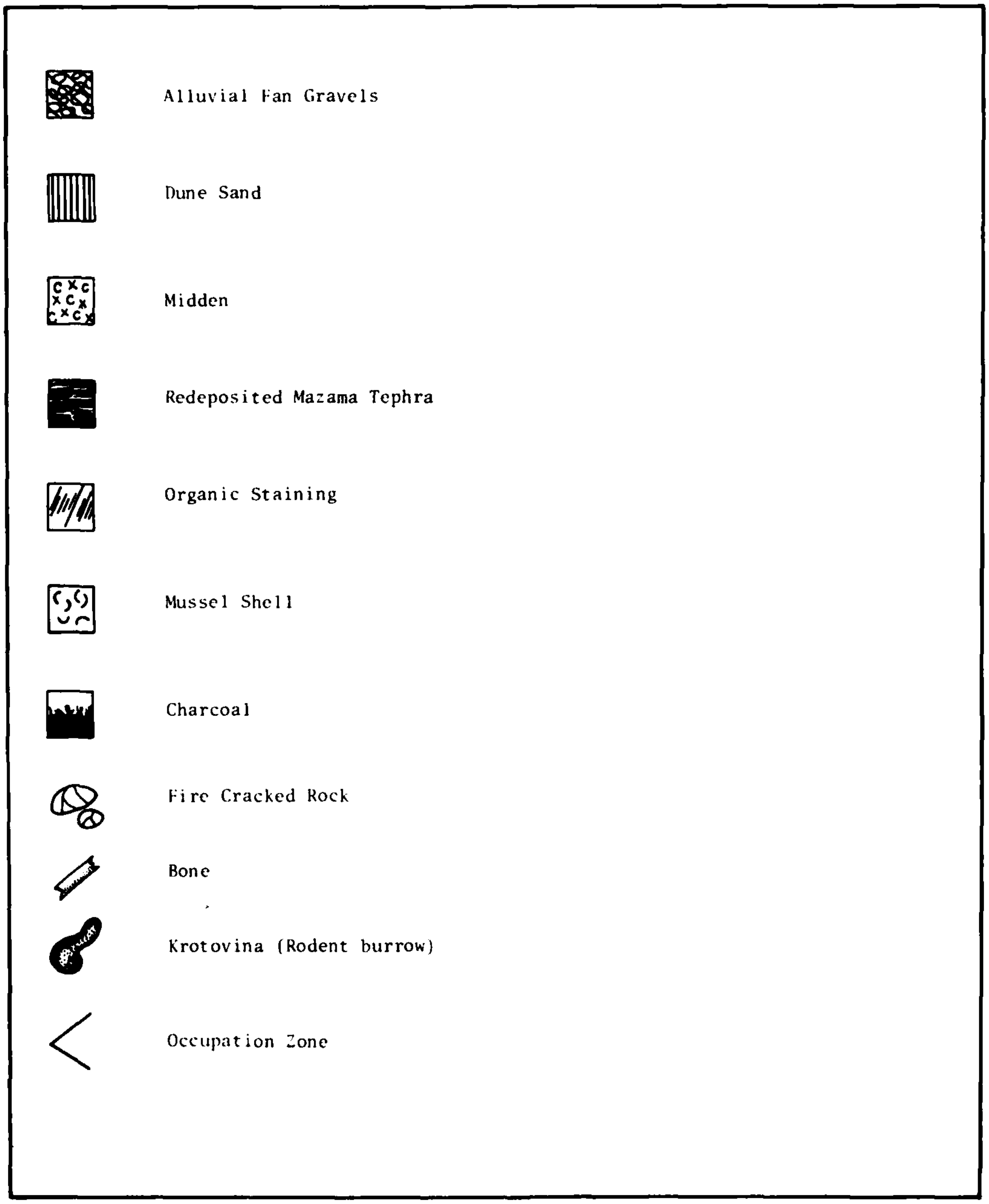


Figure 9(c). **Time-Stratigraphic Unit Summary and Key to Figures 51-53.**

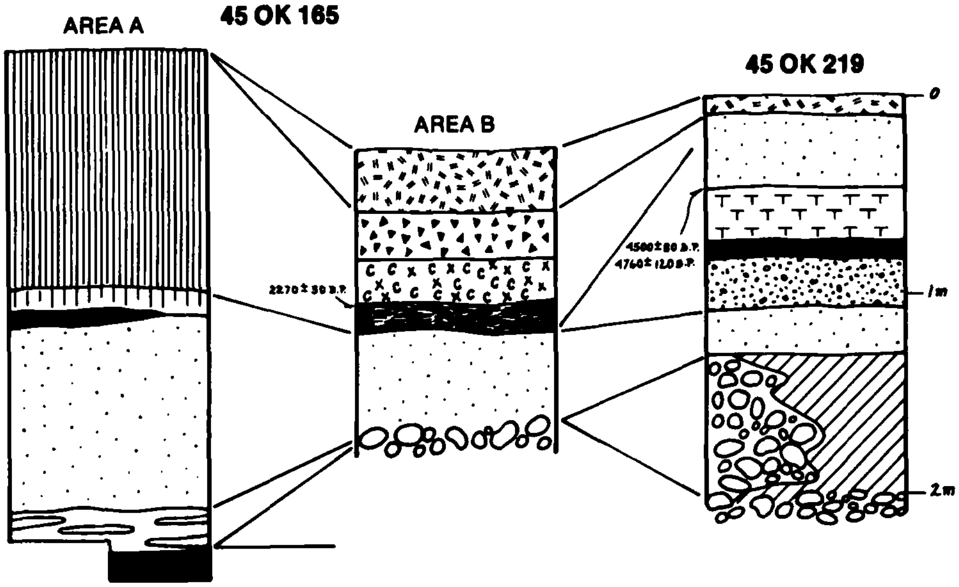


Figure 10. Cross-dated schematic profiles from sites on the T3 terrace level, RM 590 study.

and/or too dispersed for us to distinguish and functionally analyze individual occupations. One other site (45OK205), initially thought to fall into this category, was not as well studied stratigraphically as other sites and has not been dated. Therefore the geochronological sequence which we developed and report here is based on the remaining eight sites: 45OK165, 45OK207, 45OK208, 45OK219, 45DO189, 45DO190, 45DO191 and 45DO394).

In very general terms, T2 and T3 are erosional terraces (Figure 13) formed during early post-glacial times as a braiding outwash river abruptly abandoned side channels, then continued downcutting across a restricted plane. The T0 and T1 are both aggradational terraces, formed by deposition of sediment along the river's gravel banks.

Stratigraphic sequences of the T2 and T3 all begin with either Nespelem Formation silts (actually very fine sands) or the Columbia River gravels overlying those silts. River gravels, in cross-section, have the appearance of a truncated lens - a riverbed - and are overlain, first by coarse, bedded fluvial sands then a series of aeolian sand and loess deposits. When present, layers of Mazama tephra occur in these upper loessal sediments as pure or partially mixed bands. All of our archaeological occupations occur in or are contemporary with loess deposits. When pits were excavated near the backs of terraces, it was common to observe discontinuous bands of redeposited Nespelem Formation silt. These clastic (mud or landslide) flow deposits are common interbeds with the coarse fluvial sands and occur less often in upper strata.

Alluvial fan sediments also occur and in most cases unconformably overly the loess strata.

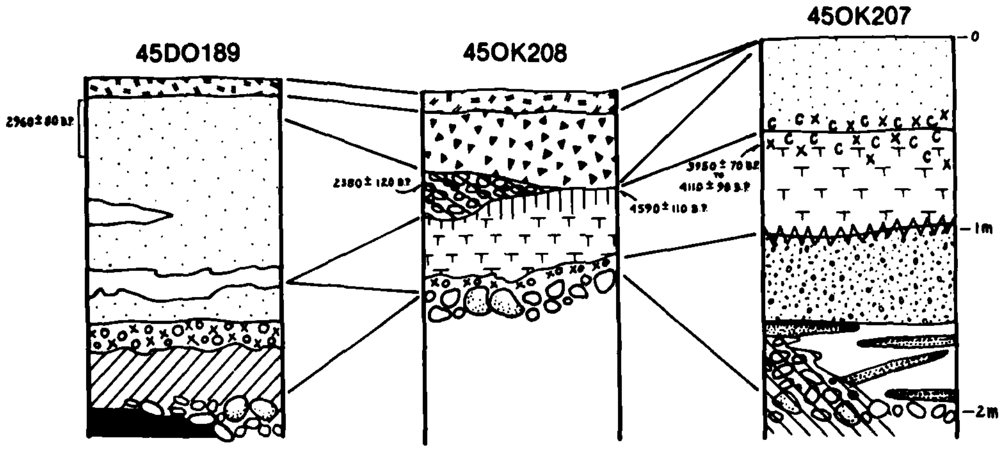


Figure 11. Cross-dated schematic profiles from sites on the T2 terrace level, RM 590 study.

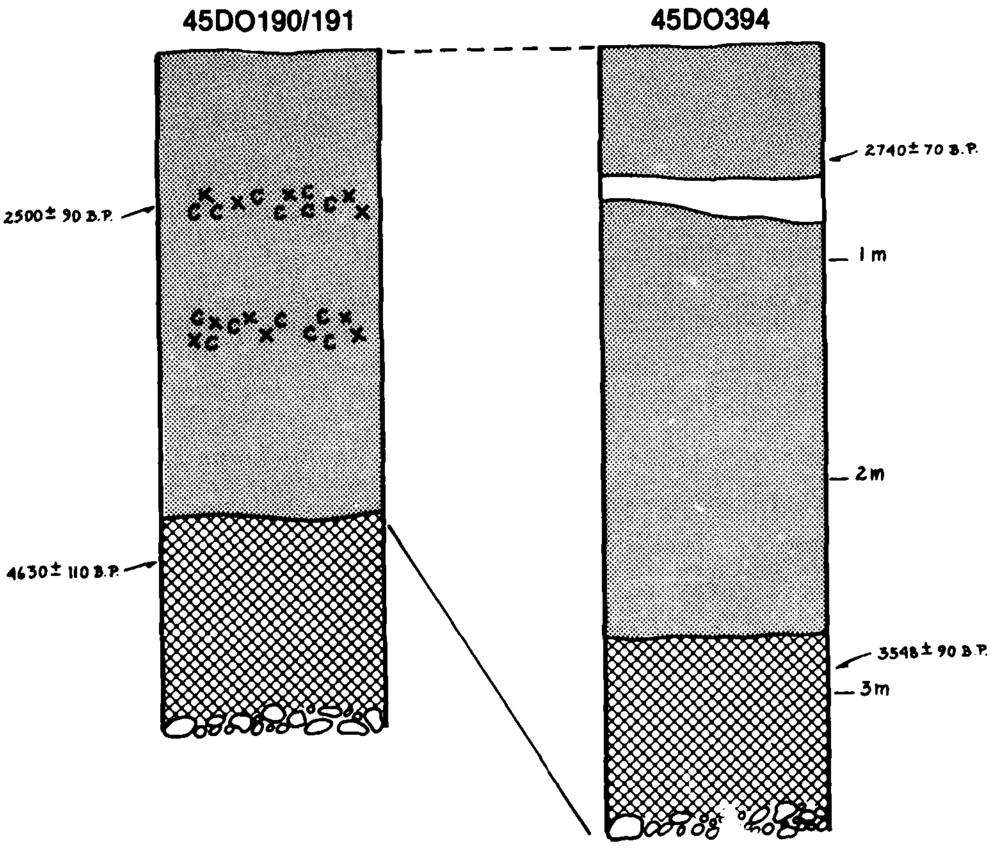


Figure 12. Cross-dated schematic profiles from sites on the T3 terrace level, RM 590 study.

Sediments at T1 level were formed almost entirely by fluvial processes. A gravel bed, usually dating prior to 4000 BP, but varying in age from around 3700 to over 5400 BP, is overlain by finely bedded, coarse to medium river sands, then a massive deposit of wind-reworked sandy alluvium up to 3m thick. Except for minor clastic flows and colluvial deposits, deposition on the T1 effectively ceased shortly after 2500 years BP. Numerous archaeological occupations occur throughout the T1 Strata.

The T0, to be more thoroughly discussed in a later report, is also entirely fluvial, its alluvial layers remaining more distinct in some areas than we have observed for the T1. Deposition of this terrace did not begin until shortly before 1800 BP.

Time-Stratigraphic Units.

The following paragraphs present a discussion of each TS unit, including brief descriptions of its locations of occurence and basis for dating. Figure 9 summarizes the time stratigraphic units and presents the age range for each. Stratigraphic positions of RM 590 occupations and the approximate ages of those occupations are listed in Table 9.

Units II Through IIIc. These are the fluvial sediments of T3. As already mentioned, Unit I, Nespelem Formation silt, is overlain by a lens of Columbia River gravels (TS Unit II) that tend to thin toward the back of the terrace and often disappear. It was in one such area at site 45OK165 (Figure 10) that we observed undeformed, eroded beds of silt beneath fluvial sands and clastic flows of reworked silt. There are three facies of fluvial origin above the gravels. TS Unit IIIa consists of medium to coarse, low-bar sands with a fine bedding structure and high magnetite content. We observed such deposits at both 45OK165 and 45OK219. Facies IIIb and IIIc, the finer upper-bar sands and interfingering clastic flows lay either above the IIIa sands (45OK219) or directly over TS Unit I silt beds (45OK219 and 45OK165).

In 45OK219, there is direct evidence for side channel abandonment by the braiding Columbia River (Appendix A, Figure 219-3). There, gravels stand at their highest levels near the terrace bank, near the modern river, and then drop gradually at least 80cm toward the terrace center, indicating a channel secondary to that which cut deeper into TS Unit I sediments. As might be expected, TS Unit IIIa and b are thicker over this back channel, left when flood waters overflowed the main channel before downcutting prevented further deposition by the river.

TS Units II and III have not been radiometrically or archaeologically dated, but we know from upper strata that they predate the Mazama eruption of 6700 BP and from previous research (Kiver and Stradling 1982) that they post date the Glacier Peak eruption of 11,300 BP. Unit I predates 13,000, the age of Mt. St. Helens S tephra found near the surface of Nespelem formation silts above Grand Coulee Dam (Eugene Kiver, personal communication).

Units IV and V. These units are an exact duplicate of the T3 fluvial sequence and are only slightly younger. Unit IV is the river gravel, Va-c the fluvial and clastic deposits overlying it. Again, fluvial deposits unconformably overly TS Unit I. Units V and IV occur at 45DO189 and 45OK207; at 45OK208, only Unit IV remains, the others having been removed by a massive landslide and/or associated flooding.

This fluvial sequence also predates the Mt. Mazama eruption; Cochran found no glass shards in Va or Vb sediments at either 45DO189 or 45OK207 (Appendix C).

Unit VI. This is a yellow-to-gray-brown silty fine to medium aeolian sand. Moderately well sorted, this deposit may represent either wind-reworked upper-bar alluvium or aeolian sands carried a short distance from the downcutting river below. TS Unit VI overlies Unit V facies at both T3 sites and at 45DO189 on the T2. Elsewhere it has been eroded away. This stratum also underlies Mazama tephra. Samples from 45OK165, 45OK219 and 45OK189 all were devoid of Mazama glass (Appendix C).

Table 9. Stratigraphic Positions and Approximate Age of Occupations.

Occupation		Underlying Unit	Overlying Unit	Incorporating Unit	Approximate Age in yr. BP
45OK207	I	XIc			<2500
45OK208	II	Erosional unconformity	XII	Lower XII	<2500
45OK165	I	Erosional unconformity	XII		<2500
45DO394	I			Upper XIb	2500-3500
45DO190/191	I			Upper XIb	2500-3500
45DO189	I			Upper XIc	2500-3500
45DO394	II			Mid XIb	3000-4000
45DO394	III			Mid XIb	3000-4000
45DO190/191	II			Mid XIb	3000-4000
45DO189	I			Mid XIc	3000-4000
45DO394	IV	Lower XIa	XIb	Upper XIa	3500-4500
45DO394	V	X	Lower XIa		3700-4700
45DO190/191	III	X, XIa	XIb	XIa	3700-4700
45OK219	II	IX	XIc		4000-5000
45OK207	II	IX	XIc		4000-5000
45OK208	II	IX	Erosional unconformity	Soil 1	4000-5000
45OK199	I	(IX)?	(XIc)?		4000-5000
45OK205	I	Unconformity		IX or VII	>5000 BP
45OK219	III		VIII	VII	>6700 BP?

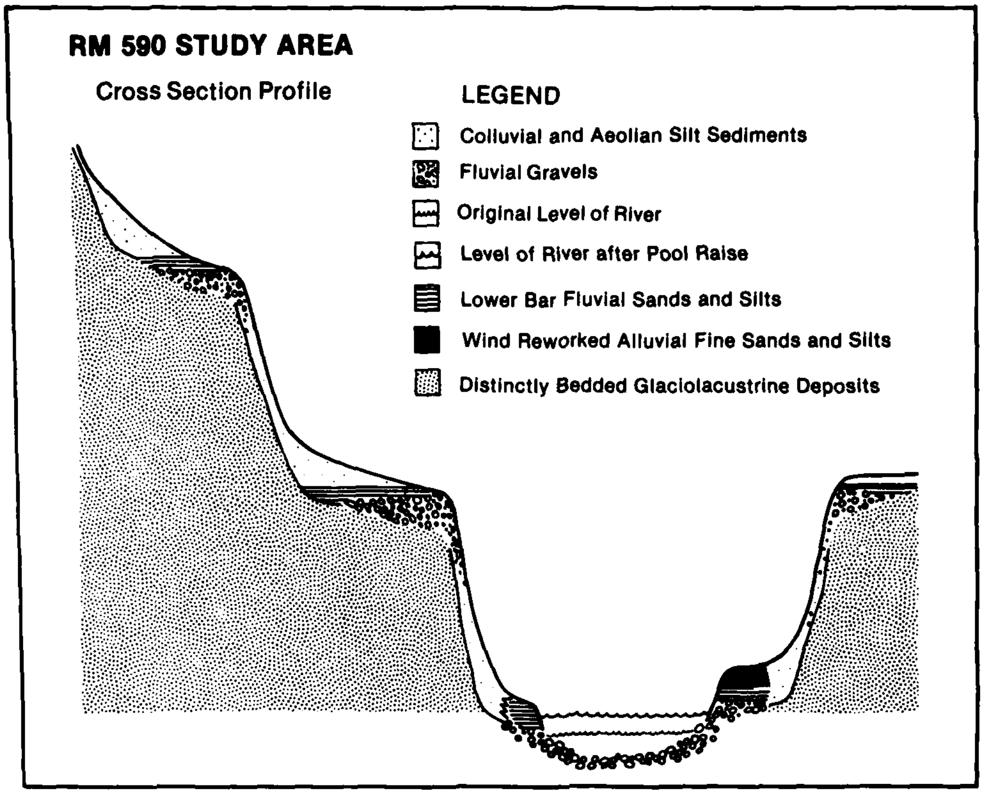


Figure 13. Schematic cross-section of terraces in the RM 590 study area.

Units VII, VIII and IX. These strata are loess units (VII, IX) and volcanic tephra (VIII) laid down during the mid-Holocene. They uniformly consist of fine, light brown loess which appears to have a minor to moderate organic content. The sediment usually is loose, but has in some areas been cemented by calcium carbonate. Unit VII underlies Mazama tephra at 45OK219 and occurs in apparently pre-ashfall context at 45OK207 (Appendix C). Near the contact between this stratum and the Mazama tephra is a narrow mixed zone, probably resulting from bioturbation.

Mazama tephra (TS Unit VIII) occurred as distinct layers in 45OK165 and 45OK219; at 45OK165 it was certainly in primary context. The glass content of this layer was 47%; at 45OK219 it was 24% (Appendix C). According to our consultant, Bruce Cochran, either stratum could be a primary deposit. In neither case was tephra observed in strata more than a few centimeters below the visible ash layer. This is surprising, considering the degree of bioturbation evident in 45OK219.

Unit IX overlies the tephra at 45Ok219 and occurs as a tephra containing loess at 45OK207 and 45OK208.

Soil 1. There is evidence for surface stability between Unit IX and X at many sites on T2 and T3 surfaces. At 45Ok165 there is a weathered, organic-rich horizon atop Stratum IX; at 45OK208 a complete soil occurs. This soil consists of a weathered, dark gray brown A horizon and a clay enriched B horizon, both of them developed in Unit IX. Bioturbation of this soil (45OK208) was extensive while the soil formed, as shown by many small rodent and insect burrows and the penetration of artifacts into this soil, beneath a gravel-sealed occupation layer. The lower occupation (II) at 45OK208 includes a date of 4590+-100 BP from a housepit cut through the already formed soil.

Evidence of former soils also occurs at 45OK207 and 45OK205. At the latter site, a calcium and silica cemented C horizon (Csi) has developed in what appear to be Unit VII and IX loess deposits, but erosion apparently has removed the associated A horizon. Artifacts from an occupation in the upper part of the Unit VII and/or IX loess is attributable to cultural Period I, dating before 4600 BP. At 45OK207 we observed an apparent Csi horizon formed in upper Unit VII loess. Again, no distinct A horizon is present, but an intensive occupation of 4100 BP age occurs atop Unit IX.

With these diverse, fragmentary pieces of information, we discern a consistent pattern: a soil formed sometime well after 6700 BP but before 4100 BP. This is Soil 1 and correlates chronologically with the 4000-5000 BP soil described by Hammatt (1977) for the Lower Snake River. Most occupations on the T2 and T3 levels occur on this surface.

Units X and XI. These sediments include Columbia River gravels (X), low (XIa) and upper (XIb) bar sediments of the T1 and contemporary fine brown loess (XIc) and clastic flows (XId) on the upper terraces. Complete fluvial sequences can be seen in both 45DO190/191 and 45DO394.

Fluvial gravels and cobbles cover a gently sloping surface approximately 2m above the present reservoir level and therefore above the Columbia's historic annual flood stage. Poorly sorted, distinctly bedded medium to coarse sands directly overlie gravels and, at 45DO394, form a crossbedded layer 20cm thick with cross-laminated bedding planes dipping toward the modern river channel at an angle of 30 degrees. These are foreset beds, the initial sediments laid on a river's point bar as the channel migrates away (Leopold et al. 1964). At both sites, the fluvial sands occur as distinct layers, with no apparent post-depositional deformation. They probably were laid down rapidly. In each case we have obtained a radiocarbon date on artifacts from the uppermost of these low-bar layers. In Unit XIa at 45DO190, the date is 4530+-110 BP; the 45DO394 date is 3548+-90 BP. Thus we suggest that deposition began at 45DO190 no earlier than 4700 BP. At 45DO394 a date of 3700 BP is likely (artifacts found on gravels support this estimate, see Appendix A). Massive wind-reworked upper-bar alluvium (XIb) at both sites contains occupation zones attributable to Period III. The uppermost occupation at 45DO394 dates 2740+-70 BP; at 45DO190/191 the date is 2500+-90 BP. In neither case is there over 40-60cm of sterile, overlying sediment. Thus, deposition of Unit XIb ended shortly after 2500 BP.

The upper layers at 45DO189, 45OK219 and 45OK205 consist of 40-60cm thick deposits of fine, brown aeolian sediment (loess), apparently derived from exposed fluvial deposits on the floodplain below. At both Okanogan County sites, this loess buries archaeological occupations dating between 4100 and 4700 BP. Period III (45OK189, 45OK219) and IV (45OK207) occupations occur in the uppermost 20-30cm of each site in the brown loess. The 3000 year-old occupation at 45DO189 is 30-50cm below surface, also within the brown loess. Therefore we conclude that this fine brown loess unit is coeval with Unit XIa and b and may represent wind-reworking of floodplain sediments laid down during the interval 4700-2500 BP. It has been designated Unit XIc.

Unit XI corresponds in age and formation process with the Middle Alluvium of Hammatt's Lower Snake River geochronology. A period of increased river flows and raised river base level is definitely indicated for this period of time (4700-2500 BP). The difference in ages between low-bar deposits at 45D0189 and 45D0190 also leads us to suggest that the river was migrating laterally across the canyon floor starting near Sanderson Creek Bar 4700 years ago. It shifted northward at this bar while still cutting into the south bank at 45D0394. By 3700 the cutting ended at 45D0394 and the channel began to shift north at that point in its bed.

Units XII and XIII. Sedimentation all but ceases with TS Unit XIb or XIc over most T1, T2 and T3 surfaces. However, there is a series of colluvial strata that post-dates 2500 BP, near the mouths of small ravines, specifically Orchard Creek and the West Fork of Fan Creek. At 45OK165 there is an erosional unconformity between Unit Va sands and a later colluvium. This colluvium includes a secondary deposit of Mazama tephra (Appendix C), and a series of thin, unsorted, (colluvial) sand deposits up to 60cm in total thickness. Charcoal found at the bottom of this stratum dated 2270+-50 BP. At 45OK208, a single flash flood event eroded most of the strata representing TS Units X and XI from the site (see Appendix A). An occupation that rests atop this unconformity and in places overlies gravels left by the flood dates 2380+-120 BP and underlies a thicker, colluvial deposit of sands, silts and gravel. The presence of historic colluvium at the surface of both sites indicates that Unit XII is still being deposited.

Considering 1) the basal dates on the colluvium and 2) the massive erosion that precedes this unit, we conclude that conditions promoting erosion of upland soils but not promoting transport of sediment loads in runoff streams beyond the T2 began between 2500 and 2260 BP and continue to the present time.

Unit XIII. This is the sequence of fluvial deposits that comprise the T0. Deposition of this unit at 45Ok197 began sometime between the end of alluvial deposition on the T1, shortly after 2500 BP and the 1870+-120 BP (Beta 5268) date from fluvial sands in 45OK197 place the onset of this alluvial deposit between 2500 and 1900 BP. This unit will be reported more extensively in a later report (45OK196, 45OK197).

Unit XX. This unit includes all strata that result from modern environmental disturbance, including plowing, sheet erosion from overgrazing and deposition of fill. They occur just below surface at most sites.

CHAPTER VII

SUMMARY CHRONOLOGY OF RM 590 OCCUPATIONS

Chronological data on 19 dated occupations are presented in tables listing stratigraphic dating (Table 9), projectile point chronology (Table 8) and radiocarbon dates (Table 7). Table 10 summarizes this information and places the occupations in the best chronological position. All dates are in approximate radiocarbon years BP. Because TS Units were formulated partly on the basis of radiocarbon dates from occupations in the study area, stratigraphic and radiocarbon dates are not independent measures in all cases. Occupations that, in summary, date to the boundary between periods are assigned to the later period.

We find a high degree of temporal clustering among our sample of occupations. Period IV (2500-1600 BP) has only three representatives, while the older Period III (2500-3500 BP) includes eight. Period II (4700-3500 BP) is well represented (N=6); however, all but one of the occupations belonging to this period fall between 4000 and 5000 BP. Period I occupations are the least abundant, especially considering the 4000 year duration of that period.

This temporal distribution replicates Salo's (1983) occupation census for the Chief Joseph Project as a whole. Several explanations might be suggested: human populations may be fluctuating; some factor may be influencing preservation of archaeological occupations; or there may be changes in people's strategy of adaptation.

Table 10. Summary Chronology of RM 590 Project Occupations.

Occupation	Stratigraphic	Stylistic	Radiocarbon	Probable Age	Period
45OK207 I	<2500	2500-1600		2500-1600	IV
45OK165 I	<2500	2500-1600	2270±70	2200-2350	IV
45OK208 I	<2500	3000-2500	2380±120	2250-2500	IV
45DO190/191 I	2500-3500	2500-3500	2500±90	2400-2600	III
45DO394	2500-3500	2500-3500	2740±70	2650-2800	III
45DO190/191 II	3000-4000	2500-3500		2800-3200	III
45DO189 I	3000-4000	2500-3500	2960±80	2900-3100	III
45DO394 II	3000-4000	2500-3500		2800-3200	III
45OK219 I	2500-3500	2500-3500		2500-3500	III
45DO394 III	3000-4000	2500-3500		3000-3500	III
45DO394 IV	3500-4500	2500-3500	3548±90	3450-3640	II/III
45DO394 V	3700-4700		>3548±90	3500-3900	II
45OK207 II	4000-5000	3500-4500	X̄=4125±90	4000-4200	II
45DO190/191 III	3700-4700	3000-4000	4630±110	4300-4700	II
45OK208 II	4000-5000	4000-5000	4590±100	4500-4700	I/II
45OK219 II	4000-5000	>4500	X̄=4630±100	4500-4700	I/II
45OK199	4000-5000			4000-5000	I/II
45OK205 I	>5000	>4500		>5000	I
45OK219 III	>6700(?)			>6700	I

CHAPTER VIII

ARTIFACT AND FEATURE ANALYSIS

The following chapters prepare building blocks for the discussion of changing patterns of resource utilization and settlement that comprise Chapter XI. We present here the analytical procedures and results for lithics, features, faunal and floral data. Based on data thus provided, we devise a classification of settlements.

Lithic Analysis and Results

We conducted an exhaustive analysis of lithic (chipped, pecked and ground stone) artifacts from RM 590 sites. For each artifact, we recorded its material, size, reduction status, wear, worn edge or area, length and angle of worn edge and its common sense "functional" name (Appendix D). The purpose of this analysis was four-fold. First, we sought information on changing patterns of lithic resource use (material type), as part of our study on patterns of adaptation. Second, also as part of the study of adaptive strategies, lithic use wear was one step in our investigation of settlement pattern, and was applied both to the definition of settlement classes and to the study of intra-assemblage diversity. Third, size and reduction status are variables useful to an investigation of tool technology. "Functional" names, finally, are merely for descriptive purposes.

Lithic Material.

We recorded lithics in nine material categories: Obsidian, Opal, Opaline, Jasper/petrified wood/chalcedony, basalt, quartzite, quartzo-feldspathic schist, argillite, mudstone, siltstone, steatite/nephrite and granite/granodiorite. There were 7102 specimens in the collection from RM 590 sites, of which the majority, by count, (4094 for 67%) were in the jasper/petrified wood/chalcedony class. Opal/opaline (1094 for 15%) and quartzite (909 for 13%) were secondary with basalt (250 for 4%), tertiary and all other materials rare.

Table 11 presents the distribution of various lithic materials among RM 590 sites.

Lithic Use Wear.

Lithic use wear analysis is an effective method for obtaining information about the ways tools were utilized (e.g., Dunnell 1978b; Keeley 1980; Odell 1975; Semenov 1964). Wear is the set of attributes which result from friction caused by an artifact's motion through another medium (Dunnell 1978). Lithic use wear experiments (e.g., Hayden 1979; Odell 1975; Semenov 1964; Tringham et al. 1974) have conclusively proven that different actions produce different attributes of wear on stone tools. Although there is no way to distinguish exactly what material a tool was used to work,(e.g., cutting of deer meat vs. cutting of soft non-fibrous vegetable material; scraping of wood vs. scraping of bone, etc.), it is possible from use wear analysis to

Table 11. Unworn lithics listed by material type.

Period	Occupation	Obsidian N	Obsidian WT	Opal/ Opaline N	Opal/ Opaline WT	Jasper/ Pet. Wood/ Chalcedony N	Jasper/ Pet. Wood/ Chalcedony WT	Basalt N	Basalt WT	Quartzite N	Quartzite WT	Quartzo-Feldspathic Schist N	Quartzo-Feldspathic Schist WT	Agrillite Mudstone Siltstone N	Agrillite Mudstone Siltstone WT	Nephrite, Steatite N	Nephrite, Steatite WT	Granodiorite/ Granite N	Granodiorite/ Granite WT	Indeterminate N	Indeterminate WT	Occupation Totals N	Occupation Totals WT
	45OK207 I			83	57	428	184	17	16	98	340			4	4					7	19	637	620
IV	45OK165 I			100	83	165	110	29	34	21	38	1	1	5	9			1	2	183	10	506	288
	45OK208 I			26	66	597	303	13	24	49	113	1	1	1	1					3	42	690	550
	45DO190/ 191 I			127	112	132	103	6	18	136	285			2	2					2	20	405	540
	45DO394 I			3	3	29	18			2	2											34	23
	45OK219 I			14	10	47	31	6	4	3	3			3	3					2	1	75	52
III	45DO190/ 191 II			200	121	284	160	12	13	153	541			3	2							652	1216
	45DO394 III									1	1									1	1	2	2
	45DO189 I			154	127	111	182	6	6	62	91	1	2	5	6					3	3	342	417
	45DO394 II			1	1	5	5			10	9											16	15
	45DO394 IV									1	93											1	93
	45DO394 V			8	3	13	4	2	9	11	44			3	4							36	64
	45DO190/ 191 III			17	22	17	33	2	2	32	268			1	12							69	337
II	45OK207 II			176	227	1401	10731	78	297	235	402	2	7	7	6					23	33	1922	11743
	45OK208 II	1	1	113	236	1505	605	66	742	103	877	1	4							20	20	1809	2485
	45OK199 I					1	1	1	15	1	20											3	36
	45OK219 II			53	30	89	51	13	9	4	5			7	4					6	3	172	102
I	45OK205 I	1	1	16	10	60	54	14	1604	15	976									4	6	100	2558
	45OK219 III			2	2	11	5	1	1	2	2											16	10

Debitage Raw Material (top) count (N) and weight in grams for CWU Project 590 Occupations (1982)
Total count and weight for each Occupation is presented to right of matrix.

identify in a general way the kind of use a tool has received. The direction and intensity of working force, the angle at which a tool is applied to the material and the hardness, toughness and chemical makeup of both the tool and the material being worked all condition the kind, shape, location, and orientation and size of wear attributes produced on a stone tool.

Thus, although lithic analysis may not enable us to reconstruct the precise activities performed at a site with stone tools, we can determine the range and proportionate performance of general categories of stone tool use (e.g., scraping of hard materials, cutting of soft materials, piercing of fibrous material). Herein we use lithic use wear analysis to distinguish classes of settlement at which similar kinds of activities were performed and to measure intra-site activity diversity.

Analysis. Use wear attributes we recorded were: kind of wear (chipping, crushing, polish; etc.); location of wear (edge, surface, point); shape of worn edge/area (concave, convex, paint); faciality of wear (uniface, biface, alternate edges); and edge angle (<60 degrees, >60 degrees). After classifying all our lithics, over 40 classes were represented in the total collection. No single occupation assemblage contained more than 83 worn edges or surfaces. Therefore, had we compared occupations on the basis of all classes, few occupations would have been much alike; the effects of sampling error would be too great. We therefore removed the edge angle dimension, combined alternate edged classes with the bifacially worn classes of each wear/shape of wear/location of wear class, and combined low frequency classes with the same kind and location of wear (e.g., crushing on surfaces; chipping and crushing on concave edges, chipping on points). This procedure produced 18 use wear-based classes, which we call tool classes, following Dunnell (1978b; tool: the maximal co-occurring set of wear attributes; the number of tools is not equal to the number of objects, tools are always more common). To this group we added projectile points (usually unworn but definitely indicative of tool using activity (c.f., Chatters 1982) as a 19th class. We did not include unworn flakes in this analysis, believing their presence to vary capriciously (reduction of a single small core can produce thousands of flakes, the number varying with material quality and proximity to the site and the flint-knapper's skill) and to have too strong an effect on percentages of other tools (e.g., with over 2000 chipped stone artifacts, 45OK208 had only 93 tools, no tool class numbered over 25 objects (1.25% of the total number of lithic objects).

Tool classes are defined in Table 12, along with the activity that could have produced each (based on Semenov 1964; Tringham 1974; Hayden, 1979). Examples are shown in Plates 4,5,6,7,8.

Results. There were 408 tools among the 7102 lithic artifacts, of which Classes 3, 7, 16 and 19 were by far the most common (Table 13). Some patterning is immediately evident among occupation assemblages. Classes 3, 16 and 19 dominate, in some assemblages, Classes 3 and 7 in some and Class 3 only in still others. This patterning is one basis we used for classifying occupations into settlements, and will be dealt with further in the Settlement Classification Chapter IX.

Descriptive "Common Sense" Artifact Categories.

To provide simple description of artifact inventories, we categorized stone (and bone, see below) artifacts according to "common sense" names commonly used by this region's archaeologists (Appendix D). There were 417 objects in this group.

Because we consider use-wear to be a more precise indicator of activity performance, and therefore of site function, we make no use of common sense artifact categories. Numbers of objects only are tabulated here (Table 14).

Table 12. Use Wear Tool Classes Used in Analysis of Settlement Patterns.

Type	Definition	Probable Use
1.	Unifacial chipped wear on a concave edge.	Scraping of thin, soft material or material with a small diameter.
2.	Bifacial chipped wear on a concave edge.	Cutting of thin, soft material or material with a small diameter.
3.	Unifacial chipped wear on a convex edge.	Scraping of wide or large diameter soft material.
4.	Bifacial chipped wear on a convex edge.	Cutting of soft material.
5.	Chipped or polished wear on a point.	Perforation or grooving of soft material; drilling.
6.	Unifacial crushing on a concave edge.	Scraping of very hard material (e.g., bone, stone).
7.	Crushing on a convex edge or surface.	Hammering, cutting or crushing of very hard material or soft material on a hard surface.
8.	Crushing on a concave surface.	Anvil/mortar-like use.
9.	Chipping and polishing on a concave edge.	Scraping of soft, acidic, or fibrous, small diameter material (fresh skin, young softwood).
10.	Chipping and polishing on a convex edge.	Scraping of soft, acidic or fibrous material, (e.g., skin).
11.	Chipping and polishing on a point.	Perforation, grooving of soft, acidic/fibrous material (e.g., skin).
12.	Chipped and abraded or polished and abraded objects.	Various.
13.	Unifacial chipping and crushing of a concave edge.	Scraping of wood or bone, small diameter.
14.	Chipping and crushing of a point.	Picking, bone breaking; perforation of a hard surface.
15.	Unifacial chipping and crushing of a convex edge.	Scraping of wood or bone of a large diameter or surface area.
16.	Bifacial chipping and crushing of a convex edge.	Chopping, cutting of wood or bone (heavy butchering).
17.	Crushing and abrasion on a flat surface.	Food or tool grinding.
18.	Crushing and abrasion on a concave surface.	Pounding and grinding (mortar).
19.	Projectile point.	Hunting, warfare, tool Preparation.

Table 13. Distribution of Tool Classes Based on Use Wear Among Occupations of All Periods.

Period	Occupation		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
	450K207	I	1		5	1		1	5												3	16
IV	450K165	I			3	1			2			1		1			1	3		1	4	17
	450K208	II		1	9	8	1		1		1	2	1		3		1	1			5	34
	45D0190/191	I	1		6	2	2	1	1							1	1	7			7	29
	45D0394	I				1	1		1													3
	45D0190/191	II	1		8	2										2	2	18			14	47
III	45D0189	I	2		7	1				1							2	12			4	29
	45D0394	II																2			1	3
	450K219	I	1		6																1	8
	45D0394	III			1																	1
	45D0394	IV																			1	1
	45D0394	V				1																1
	450K207	II	5		21	6	4		3	1				1		1	7	16	1	1	13	77
II	45D0190/191	III			2													3			2	7
	450K208	II	3	2	17	16	1		8	5		3	1	1	2		7	15	2		10	93
	450K219	II	2		5	1	1											1			2	12
	450K199	I							1									2				3
I	450K205	I	1		6	2			1									1			1	12
	450K219	III	1		2																	3
	TOTALS		18	3	108	42	9	2	23	7	1	6	2	3	5	4	21	81	3	2	68	408

Table 14. List of Artifacts from RM 590 Occupations.

Occupation	Util. flake/chunk	Unifacially ret. fl.	Biface. retouch. fl.	Resharpening flake	Amorph. fl. object	Burin spall	Biface	Project. pt., whole	Project. pt., base	Project. pt., tip	Blade	Microblade	Drill	Graver	Scraper	Spokeshave	Core	Tabular knives	Hammerstone	Maul	Pestle	Edgeground cobble	Netsinker	Chopper	Millingstone	Hopper mortar base	Anvil	Bead	Pipe	Punch	Total
45OK207 I	3	1					3	4	2	1						1		1	5				1								22
45OK165 I	6				1		4	1	2	1					1		1	3	1			2		2							25
45OK208 II	4		2				3	3	1	1			1	1		1	1	7	1					1				2			29
45DO190/191 I	2		2		1		2	2		1				1				8	1												20
45DO394 I	1																			1							1				3
45DO190/191 II	2		1		3		4	3						2	2	1	1	6		1							1				27
45DO189 I	7				1		2	3	1						1	2		14									1				32
45DO394 II								1										2													3
45OK219 I	2				1													1													4
45DO394 III				1											1																2
45DO394 IV	1																										1				2
45DO394 V	1							1																				5			7
45OK207 II	18	1			2		7	8	3	2			1	4	3	2	1	25	2			2						3			84
45DO190/191 III	1							1		1				1				1													5
45OK208 II	18	2	4		1		1	7	2	1		3	1	1	1		8	17	8					2	2			1			80
45OK219 III	3	1						1	1						1	1															8
45OK199 I																					1			2							3
45OK205 I	9									1								1	1												12
45OK219 II	2					1										1		2													6
TOTAL	80	5	10	1	9	1	26	35	12	9		3	3	10	10	9	12	88	19	2	1	4	1	7	2		4	11			374

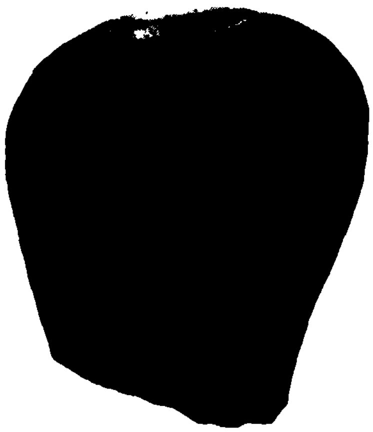
Plate 4. Examples of objects with use-wear of classes 2 (a-d), 3 (i-l), 4 (c) and 5 (f-h). All items actual size. Traditional names for the objects are listed in the Table below, along with provenience data.

Item	Site	Unit	Depth	Name	Artifact Cat. #
a.	45OK219	60S/0W	0-20cm	Spokeshave	#8
b.	45OK219	45S/30E	80-100cm	Spokeshave	#36
c.	45OK208	22S/18W	40-50cm	Tab knife	#46
d.	45OK208	20S/17W	60-70cm	Tab knife	#90
e.	45OK208	17S/13W	50-60cm	Bif. ret. flake	#69
f.	45OK219	0N/15W	60-80cm	Graver	#3
g.	45OK197	3.4S/54.9W	Strat. VIIC	Graver	#49
h.	45OK207	17S/1W	50-60cm	Drill	#38
i.	45OK219	0N/15W	20-40cm	Unif. ret. flake	#2
j.	45DO191	80N/5E	80-100cm	Scraper	#24
k.	45OK208	15N/30W	0-20cm	Util. flake/chunk	#2

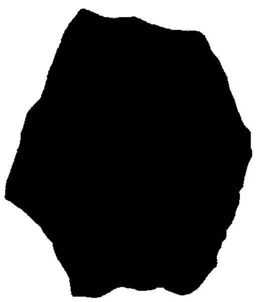

a
b
c
d
e
f
g
h
i
j
k
l

Plate 5. Examples of artifacts with use-wear of classes 4 (d), 6 (a), 9 (b) and 11 (c). Items b, c and d are actual size; item a is one-half actual size. Traditional names for the objects are listed in the Table below, along with provenience data.

Item	Site	Unit	Depth	Name	Artifact Cat. #
a.	45DO190	19.95N/10.3W	80-100cm	Core	#18
b.	45OK208	20S/12W	40-50cm	Biface	#88
c.	45OK208	21S/14W	30-40cm	Biface fragment	#11
d.	45OK208	24S/13W	31cm	Tabular knife	#86

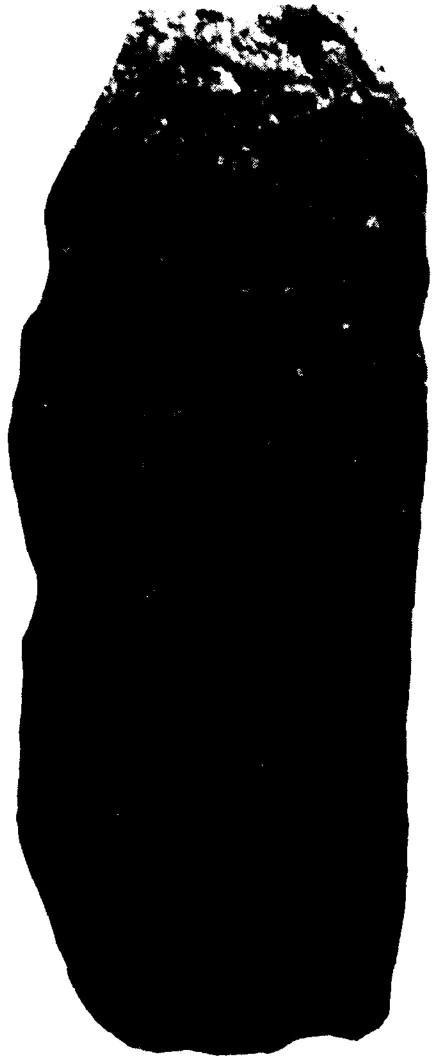


a



b

c



d

Plate 6. Examples of artifacts with use-wear of classes 7 (a-c), 10 (h, i), 14 (e, f) and 15 (d, g). Items a-d are one-half actual size. All others are actual size. Traditional names are listed in the Table below, along with provenience data.

Item	Site	Unit	Depth	Name	Artifact Cat. #
a.	45OK208	23S/18W	40cm	Hammerstone	#51
b.	45OK165	1S/44W	20-30cm	Hammerstone	#10
c.	45OK165	13S/49W	20-40cm	Edge Ground Cobble	#9
d.	45OK219	45S/0W	100-120cm	Tabular flake	#37
e.	45OK208	21S/14W	50-60cm	Bifac. ret. flake	#36
f.	45OK207	28S/1W	100-110cm	Graver	#13
g.	45OK208	21S/12W	40-50cm	Tabular flake	#92A
h.	45OK208	15S/21W	10-20cm	Scraper	#9
i.	45OK208	21S/12W	40-50cm	Tabular flake	#92B

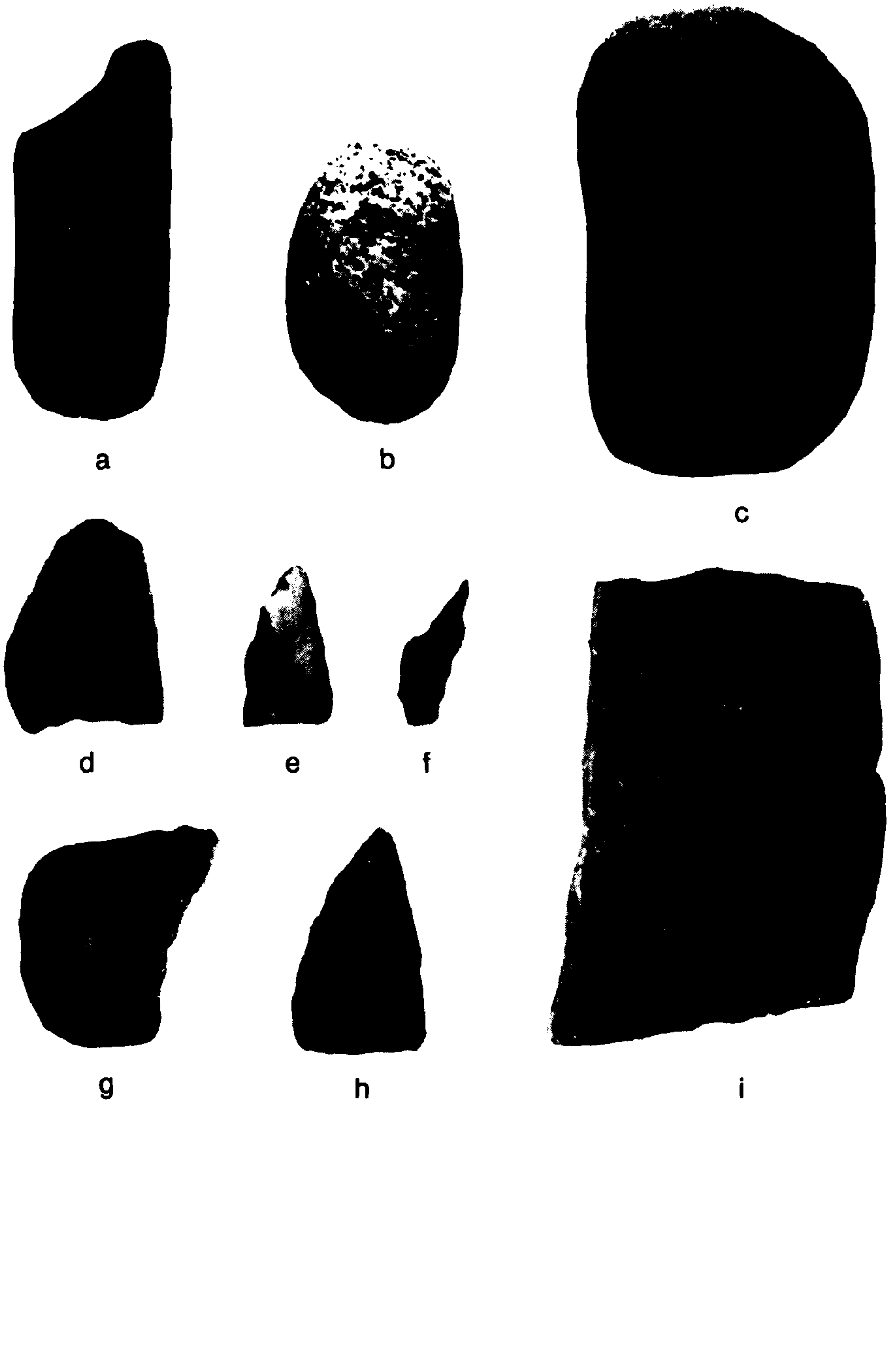
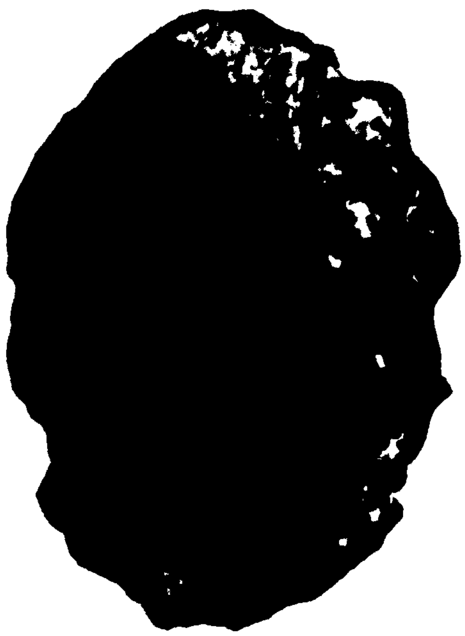

a
b
c
d
e
f
g
h
i

Plate 7. Examples of artifacts with use-wear of classes 12 (c, d) and 13 (a, b). Items a and b are actual size, c and d are one-half size. Traditional names are listed in the Table below, along with provenience data.

Item	Site	Unit	Depth	Name	Artifact Cat. #
a.	45OK208	22S/16W	50-60cm	Chopper	#85
b.	45OK208	21S/14W	40-50cm	Tabular knife	#42
c.	45OK165	15N/15E	80-100cm	Tabular knife	#4
d.	45OK207	22S/16W	130-140cm	Chopper	#53



a

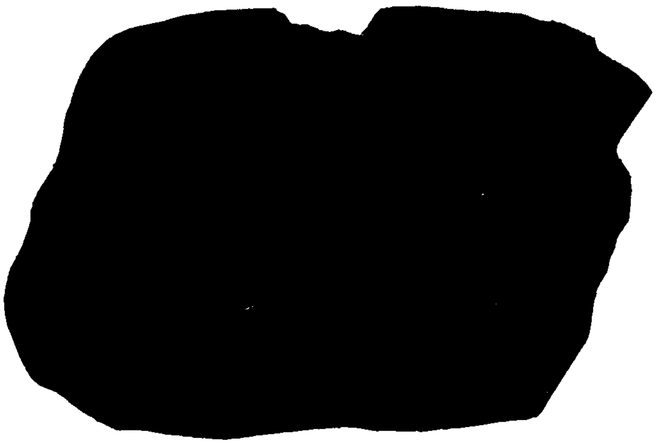
b

c

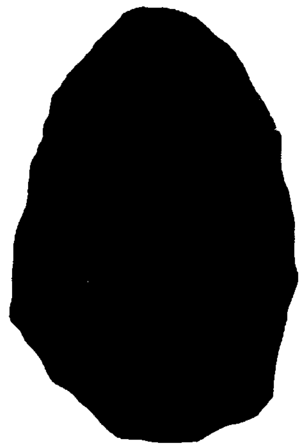
d

Plate 8. Examples of artifacts with use-wear classes 16 (b, d), 17 (c) and 18 (a). Item a is one-fourth actual size, c is one-half size and c and d are actual size. Traditional names are listed in the Table below, along with provenience data.

Item	Site	Unit	Depth	Name	Artifact Cat. #
a.	45OK208	20S/17W	77cm	Millingstone	#102
b.	45OK208	22S/14W	0-100cm	Biface	#7
c.	45DO394	Surface		Pestle	#5
d.	45DO189	19N/6E	140-160cm	Tabular knife	#16



a



b

c

d

Table 15. Feature Definitions[1]

Feature	
Hearth	Any feature on the occupation surface less than 2m in diameter showing evidence of in situ fire as indicated by a cluster of fire modified stones and/or charred bone and/or charcoal and oxidized earth.
Earth oven	A basin shaped pit of varying depth filled with stones and showing evidence of in situ fire, no size restriction.
Shell and FCR Concentration	A continuous layer of varying thickness consisting of mussel shell and fire modified stones covering an area at least 50cm in diameter. Bone, tools and stone flakes may or may not be present.
Pit	A pit of varying shape (regular or otherwise) under 4m in diameter and lacking the floor contents as described below.
Housepit	A pit of varying, regular shape (i.e., circle, oval, square) and size with a flat or slightly saucer-shaped floor that covers an area at least 4m in diameter and exhibits a high artifact density and organic content.

[1]This list is not exhaustive of possibilities, but is merely prepared to cover those features actually found during the RM590 project.

Features

Features are non-portable, non-discrete associations of artifacts (e.g., stains, clusters of tools and detritus, bone, shell or charcoal concentrations). Our purpose in analyzing features was not descriptive, but related only to the elucidation of change in strategies of adaptation. Features are meaningful with respect to adaptation in the sense that they are the concentrated material residue of resource acquisition (e.g., wiers, game drive lanes, quarrying), processing (ovens, stone boiling areas, drying racks, cooking fires, lithic reduction areas), consumption (trash piles, heating fires) and storage/maintenance (cache pits, houses). Houses specifically are indicative of long-term (e.g., greater than a few days) residence at a locale and serve to identify sites as residential bases (Binford 1978; 1980).

We have used a relatively simple classification scheme for non-house features, for several reasons: the small scale of our excavations often prevented us from exposing complete features; only a small number of features was encountered (N=37; see Table 16); and midden concentrations (shell, fire broken rock and bone scatter concentrations) were not always immediately recognized as features by excavators. We discerned only five feature classes (Table 15) including hearths, earth ovens, shell and fire broken rock concentrations, pits and housepits.

Table 16. Feature Summary for RM 590 Occupations.

	Occupation	Pithouse	Shell/FCR	Pit	Hearth	Earth Oven	Totals
IV	45OK207 I	?	1				1
	45OK165 I	1	2	1	4		8
	45OK208 I		1			1	2
III	45DO190/ 191 I	1	2		1*		4
	45DO190/ 191 II	1	1		1		3
	45DO394 I		1				1
	45DO189 I	1	?		1*		2
	45DO394 II		1		1		2
	45DO219 I						0
	45DO394 III				1		1
	45DO394 IV		1		1		2
II	45DO394 V						0
	45OK207 II	4	4	1*	?		9
	45OK208 II	1	2		1		4
	45OK219 II	1	4+		1		5
	45DO190/ 191 III				1		1
	45OK199 I						0
I	45OK205 I		1				1
	45OK219 III						0

*Located within a housepit

Houses provided more information than did non-house features, particularly at the scale of our excavations. We were able to discern the approximate plan, horizontal dimensions, floor profile, depth and number of floors (occupation events) in each house.

Results: Nonhouse Features. Our excavations exposed portions of 37 nonhouse features, of which most were hearths 13 and shell midden concentrations 21. A single pit was found in 45OK165 and one in 45OK207 II, HP 4. Only one earth oven was found (45OK208 I). The round-bottomed pit feature in 45OK207 II (Appendix A) was nearly 80cm in diameter and 80cm deep. It had been excavated into the floor of HP 3 and gradually backfilled with sand and cultural material. Because it contained no evidence of insitu burning, because it contained no mass of trash and no burial, this feature may have been a storage pit. We did not uncover enough of the pit feature in 45OK165 to discern its possible function. It differed from the 45OK207 storage pit in being filled with larger fragments of wood charcoal, and most likely served as some sort of cooking facility (perhaps a cleaned-out earth oven).

Table 17. House Features.

Occupation	House No.	Shape	LxW	No. Floors	Depth of Lowest Floor[1]	Floor Profile
450K165 I	1	(Circular)	? 2-10m diameter	3+	80-100cm	?
45DO190/191 I	1	(Circular or oval)	?	1	110cm	Level?
45DO190/191 II	1	?	?	1	100cm	?
45DO189 I	1	Circular or square	9mx(9m?)	1	130cm	Level
450K207 II	1	Circular or square	12m diameter	2	120cm	Upper, saucer lower, level
	2	(Circular or square)	(10m diameter)	1	80-100cm	?
	3	(Circular or square)	(10-11m diameter)	1	80-100cm	?
	4	(Circular or square)	?	1	?	?
450K208 II	1	Oval	6mx11m	1(?)	30cm	Level
450K219 II	1	?	?	1	120cm	?

[1]Depth below occupation surface, not modern ground surface

Housepits. Our test excavations, with the aid of proton magnetometry and the presence of surface depressions, located 10 prehistoric housepits among seven occupations (Table 17). Because our effort was confined to test excavation, and limited in its funding base, we were unable to determine the precise outline of any housepit, although we could discern the approximate plan. In most cases we were unable to excavate enough area to determine house sizes or floor profiles. What we did obtain, however, was a full understanding of the depth of each floor below the occupation surface and the number of floors in each house.

Houses ranged in depth from 30cm to 130cm below the approximate land surface at the time of occupation. The shallow house (an oval pit structure at 45OK208) is unique; it is also the oldest of our house features. All others range from 80-100 to 130cm; no temporal trends in size or wall form can be seen among these deeper housepits with our small sample.

In sites 45OK189, 45DO190/191 I and II we found single housepits which our tests and proton magnetometry indicate are the only such features present. We found only one house in each of 45OK208, 45OK219 and 45OK165, but others may be present. Based on our data, 45OK208 II was the only multiple-house occupation. There, HP 1, 2 and 4 overlapped; only HP 3 was separate. Thus no more than two houses could have been inhabited simultaneously even though all are approximately the same age.

Only two housepits contained more than one floor layer. These were HP1 at 45OK207 II and HP 1 at 45OK165. At 45OK207 II, the two floors were 50cm apart, indicating abandonment of the house for an indeterminate period of time. The situation is different at 45OK165, where at least 3 floor layers could be distinguished, each 20-30cm above the other, with no definite breaks in occupation between. Except for a massive colluvial sand stratum covering the lowest floor, the house fill is a solid, organically-stained midden throughout; lenses of fire cracked rock serve to mark distinct floor surfaces above the colluvial sand.

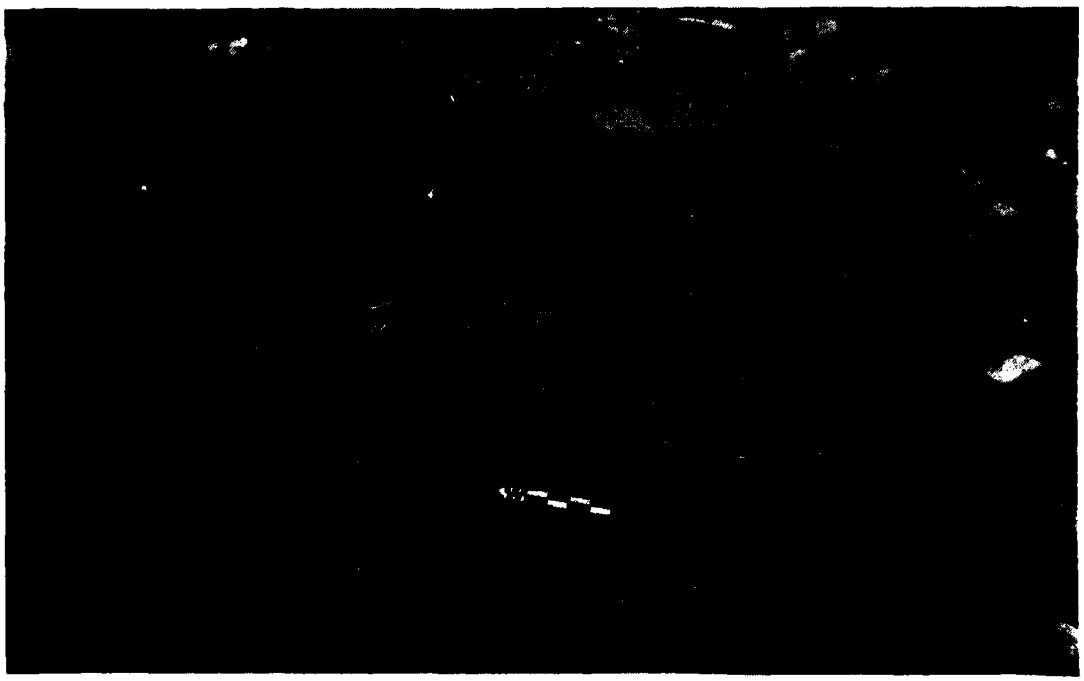


Plate 9. Examples of RM 590 features, on the left is Housepit 1 (Feature 3), 45OK208 III. Cobbles at bottom of excavation blocks mark the edge of the housepit floor. Dashed line follows approximate outline of housepit floor. View is to the west. On the right is the earth oven feature (Feature 4) from 45OK208 I.

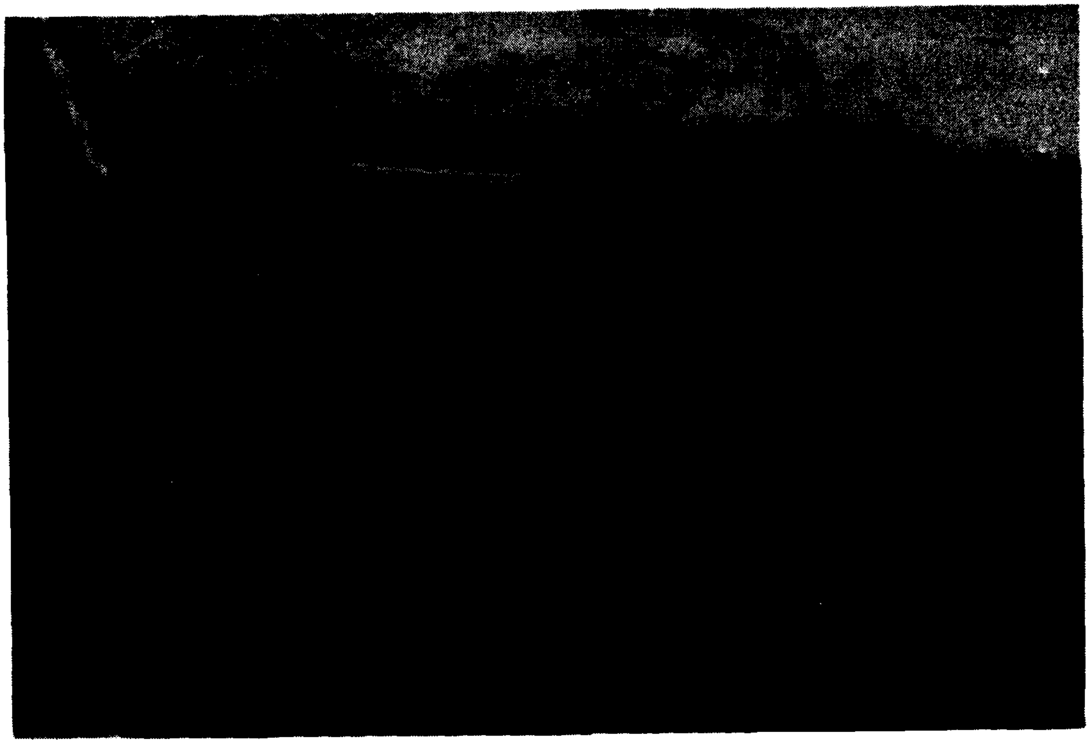


Plate 10. An example of a shell and fire broken rock concentration. This is a profile of the midden deposit in the floor of Housepit 4, 45OK207 II.

Floral and Faunal Remains

Floral and faunal remains (bones, shells and plant macrofossils) provide the most direct evidence of how the former human population used local species (Chatters 1982a; Madsen 1981; cf., Thomas 1981). The data we derive from floral and faunal remains provide us with insights into the kinds and proportionate importance of different species, hunting and gathering behaviors, the nature of foraging strategies (e.g., pursuit vs. encounter strategies, cf., Pianka 1978) and the season or seasons of year people inhabited certain localities. All this information is pertinent to the identification of settlement and resource utilization patterns and therefrom, the reconstruction of prehistoric strategies for adaptation. In addition, the remains of plants and animals extracted by people from the natural environment, help us to identify which species were most important to prehistoric human populations. It is through this group of important species (known as the effective environment, Allee et al. 1949) that economic selective pressures impinge upon competing forms of human adaptation. Floral and faunal data are, thus, a key element in the study of evolutionary human paleoecology (Chatters 1982a).

Flora.

We had hoped to use floral remains as an important indictor of subsistence practices and adaptive strategies; our hopes weren't realized.

Table 18. Plant Macrofossils Identified from RM 590 Flotation Samples.

		Taxon														
		Softwood						Hardwood								
Occupation	Provenience	Juniperus	Pinus p. or c.	Psuedotsuga sp.	Abies sp.	Other softwood (unk.)	Total softwood	Artemisia tridentata	Sabix	Alnus or ledum	Ribes	Holodiscus	Crataegus	Unknown	Total hardwood	Total
45OK165 I	30S/105W 120-140cm Housepit 1		8								1	1				10
	15N/0W 20-40cm Feature 1, Hearth	4		3	1	2	10						8	3	11	21
45OK207 II	18S/1W 175cm House 1, Lower floor								3	7					10	10
	13S/1W 85-90cm House 1, Upper floor		1				1	16						2	18	19
TOTALS		4	9	3	1	2	11	16	3	7	1	1	8	5	39	60

Procedure. Flotation samples taken from feature matrix were processed in the CWAS laboratory. Each sample was air dried, then poured into a screen-bottomed basket submerged in water. All organic material that floated to the surface or hung suspended in the water column was skimmed off with a tea strainer (seive size .78mm). This material and the heavy, screen-caught residue were dried, weighed and packaged separately.

Both float and residue were inspected under 10x magnification for fragments of carbonized wood, seeds or other plant tissue 1mm or larger in size; very little was observed among samples from sites reported in this volume (45OK196 and 45OK197 contained copious plant macrofossils). Based on the meager quantities of charcoal, only four samples, two each from 45OK165 and 45OK207 were submitted for identification.

Samples were identified by Dr. Lawrence Leney, a wood anatomist of the University of Washington College of Forest Resources (since retired). Details of his approach are presented in Appendix F.

Results. Identifications are presented by count, only (Table 18) hardwoods included Ribes (gooseberry or currant), Holodiscus (ocean spray), Crataegus (hawthorn), Alnus (alder) or Ledum (Labrador tea), Artemisia tridentata (big sagebrush) and Salix (willow). Pinus cf., either contorta (lodgepole pine) or ponderosa (yellow pine), Pseudotsuga (douglas fir) and Abies (true fir) and Juniperus (juniper) were the softwoods. No root or seed tissue was observed.

These samples are neither large enough nor from enough sites to allow any tentative conclusions to be drawn. All species either grow in the vicinity today or could have arrived in the area as driftwood from more northerly or easterly plant communities.

Fauna.

Faunal remains were analyzed both as a means for formulating occupations into settlement classes, and as a source of data on changes in resource utilization and exploitation patterns.

Procedures. Faunal remains were identified, when possible, to the nearest taxon (family, genus or species) using comparative collections of the CWU Department of Biological Sciences and the personal collection of Dr. Chatters. Where mammal bone could not be identified beyond class, but its size could be determined, we recorded it as elk size, deer size, dog size or marmot size. In addition, we recorded the element, side, fragment, portion, age, epiphyseal fusion, tooth eruption and wear) and presence of burning or butchering marks. Data were tabulated in the same manner using the same coding system as the CJDCRP.

We quantified bones as both numbers of identified specimens (NISP) and minimum number of individuals (MNI). Grayson's (1973) average distinction approach and White's (1953) basic method were used to establish MNI for each occupation. Because it is the better of two less than ideal measures of taxon abundance (Grayson 1979) NISP is the only measure we use in comparing assemblages.

In working with the results of faunal identification we have made one assumption about the agents of bone deposition for the various taxa. Using the approach of Chatters (1976), we consider as human introduced or "cultural" bone (Thomas 1971) only those taxa that do not commonly occur naturally at the deposition site. Using the concept of an artifact as any phenomenon with characteristics that are not attributable to natural processes (Chatters 1976, 1982; cf., Dancey 1981), we determined which bones would occur in natural abundance in the sites and subtracted these from the total assemblage of taxa, leaving a group of animals we could assume with some assurance to have been introduced into the site by people. Animals that occurred in deposits free of stone, tools, flakes, mussel shell (these were clearly in unnatural position), FCR, and organic staining were all fossorial rodents: ground squirrels, pocket mice, voles, gophers. These are endemic rodents; all other taxa were treated as cultural, including snakes.

We also recorded count, weight and degree of burning for non-identifiable bone. That information (presented in site reports only) has not formed a key part of our functional analysis. Neither have we used mammal bone identified only to size; that distinction is highly subjective and counts are too subject to differential bone destruction and decay to be of value here. Mussel shell also is listed but it is so ubiquitous that we have not used it in any analysis.

Results. Our test excavations covered only small areas of each site. Although we recovered pieces of fragmentary bone, a relatively small proportion of the total was identifiable. As a result, our sample of identified bone is small, only 764 elements from 17 of 19 dated occupations ($\bar{X}$=45 elements per occupation). (Tables 19 and 20) Occupations 45OK207, 45OK208, 45DO190/191 I and II exceeded the mean;

Table 19. Identified Faunal Specimens from RM 590 Occupations[1, 2]

			Artiodactyla									Rodentia				Reptilia			Pices				
Period	Site	Occupation	*Bos* (Cow)	*Ovis aries* (domestic sheep)	*Bison*	*Ovis canadensis* (Mt. Sheep)	*Odocoileus* (deer)	*Cervus* (elk)	*Antilocapra* (pronghorn)	*Canis* (dog, coyote)	*Lepus* (hare, jackrabbit)	*Marmota* (marmot)	*Ondatra* (muskrat)	*Castor* (beaver)	*Erethizon* (porcupine)	*Chrysemys* (painted turtle)	*Crotalus* (rattlesnake)	Other Snake	*Salmonidae* (salmon, trout)	*Cyprinid/Catostomid* (minnow/sucker)	Bird	Total Vertebrate	Total Invertebrate (*Margaretifera falcata*)
	45OK207	I				1(1)	2(1)					1(1)										4	396
IV	45OK165	I	2*(1)	1*(1)		1(1)	22(2)	2(2)				2(1)				8(1)			12		2	49	1475
	45OK208	I				1(1)	9(1)								1(1)	6(1)						17	4584
	45DO190/191	I				2(1)	38(1)	2(1)	1(1)			13(2)		1(1)		19(1)			10	2	2	90	4034
	45DO394	I				6(1)	2(1)															8	12
III	45DO190/191	II					44(4)		1(1)			5(1)		2(1)		13(1)			7		1	73	511
	45DO189	I	1*(1)		1(1)	1(1)	9(1)		2(1)										18		1•	33	17
	45DO394	II				3(1)	9(1)															13	278
	45OK219	I					7(1)															7	79
	45DO394	III																				0	21
	45DO394	IV				1(1)																1	438
	45DO394	V				2(1)	1(1)						1(1)						2			6	3
	45OK207	II			1(1)	3(1)	57(2)			3(1)	1(1)	3(1)				18(2)			62	4	2	150	9775
II	45DO190/191	III				1(1)						1(1)			1(1)	8(1)						11	48
	45OK208	II				2(1)	48(4)	1(1)								7(1)		1	20	2	2	84	9668
	45OK219	II				1(1)	13(1)			1(1)	4(2)			1(1)•		1(1)			47		1	69	2112
I	45OK205	I					1(1)	1(1)		1(1)	1(1)						5	3	1		4	17	695
	45OK219	III																				0	35
	TOTALS		3*	1*	2	25	261	6	4	6	6	26	1	4	2	80	5	4	179	8	15	634	34,181

*Domestic fauna, not attributable to prehistoric habitation and excluded from raw totals

•Tool or ornament

[1]Occupations are listed in chronological order

[2]Figures are NISP, with MNI in parentheses; endemic rodents are not included

Table 20. Endemic Rodent Bone from RM 590 Occupations.

Period	Occupation		*Spermophilus* (ground sqrl.)	*Microtus* (vole)	*Lagurus* (sage vole)	*Peromyscus* (deer mouse)	*Perognathus* (pocket mouse)	*Thomomys* (gopher)	Total
IV	45OK207	I							
	45OK165	I	2(1)	2(1)					4(2)
	45OK208	I	1(1)					11(3)	12(4)
III	45DO190/191	I	3(1)			1(1)		4(1)	8(3)
	45DO190/191	II	3(2)	1(1)	1(1)			8(3)	13(7)
	45DO394	I			1(1)				1(1)
	45DO189	I						21(3)	21(3)
	45DO394	II						6(2)	6(2)
	45OK219	I							
	45DO394	III							
	45DO394	IV							
II	45DO394	V							
	45OK207	II	2(1)	3(2)				32(7)	37(10)
	45OK208	II					1(1)	16(3)	17(4)
	45OK219	II					2(1)	1(1)	3(2)
I	45DO190/191	III	1(1)					1(1)	2(2)
	45OK205	I	1(1)					6(3)	7(4)
	45OK219	III					1(1)	1(1)	2(2)
	TOTALS		13(8)	6(4)	2(2)	1(1)	4(3)	107(28)	133(46)

1. Figures listed are NISP, with MNI in parentheses.

Table 21. Tools of Bone, Antler and Tooth from RM 590 Sites.

Occupation		Awl	Awl/pendant	Leister barb	Bone point	Antler wedge	Beaver tooth chisel	Bird claw pendant	Fragment	Total
45DO189	I							1		1
45DO190/191	I			1						1
45DO394	I	1								1
45OK207	II	1			1					2
45OK219	II	1					1			2
45OK219	III		1			1				2

(Column headings grouped under "Object Descriptor".)

all other occupations contained smaller assemblages. In addition to bone, we obtained massive numbers of mussel shell hinges, all of them Margaritifera falcata.

Culturally introduced bone (Table 19) consists of 18 taxa (excluding domestic cattle and sheep), most of which are rare (11 taxa represent under 1% each of the total). The majority of identified elements were from deer (41%), salmonid fishes (salmon and trout, 28%) and turtles (13%). Only two other species reach 4% of the total: mountain sheep and marmot. Elk, dog/coyote, hare, birds and cyprinid/catostomid fishes (squawfish and chubs/suckers) occur frequently in low numbers; bison, pronghorn, muskrat, beaver, porcupine and snakes are rare.

Modified Bone. The amount of modified mammal and bird bone recovered from our group of sites was so small that this category of artifacts cannot be used in any detailed analysis of settlement pattern. We list only common-sense descriptive names for modified bone (Table 21). Finds included splinter and deer metapodial awls, a bird claw pendant, a leister catch, one wedge, a bone "point", a beaver incisor chisel and several fragments of cut and incised bone (Plate 11).

Most interesting among these finds are the incised, perforated awl and elk antler wedge from Occupation III at 45OK219. Antler wedges previously had been ascribed only to later phases in Columbia Plateau prehistory (e.g., Leonhardy and Rice, 1970; Nelson, 1973). Occupation III dates to Period I. It underlies Mazama tephra and, therefore, may predate 6700 years BP.

Plate 11. Bone tools and ornament from RM 590 sites. Items are: a leister barb (a), beaver tooth chisel (b), bird claw pendant (d), bone point (f), antler wedge (g) and awls (c, e, h-k).

CHAPTER IX

SETTLEMENT CLASSIFICATION AND SEASONALITY

The purpose of this chapter is to present the procedures employed to devise a content-based settlement classification of Study Area occupations. The settlement classes that result from this analysis are used in chapter XI to construct a sequence of settlement patterns for the Study Area. These patterns, together with data on resource utilization, form the foundation for our discussion of the evolution of adaptive strategies in the central Columbia Plateau (Chapter XII).

Procedure

The classification scheme used for occupations was paradigmatic (Dunnell 1971); classes were created by specifying all possible combinations of the attributes in a set of dimensions. Settlement classes that result from this analysis are far more comprehensive in their use of functional characteristics of occupations than are classes formulated in only one dimension. As a result, they should come closer to representing the spatial distribution of people's adaptive activities.

Three dimensions were used in the present study: faunal taxa, lithic use-wear classes, and feature content. The selection of attributes considered in each dimension is discussed below.

Features.

Occupations were assigned to occupation feature classes on the basis of their content, the presence and absence of various kinds of features. Attributes considered in the classification were the presence or absence of housepits, shell and FCR concentrations, earth ovens and hearths. Classes and their definitions are presented in Table 22 and include: H, all occupations with pithouses; T, non-house occupations with earth ovens and shell/FCR concentrations; S, non-house occupations with shell/FCR concentrations but no earth ovens; and V, sites with hearths only.

This classification is based on an assumption of activity-feature relationships. We assume that pithouses bespeak base-camp function for a site and represent a high energy investment in shelter. Pithouses, thus represent, in our view, semi-permanent base-camp use of a site. Mussel shell and FCR concentrations (middens) are trash piles representing concentrated cooking and shellfish processing activity. They indicate that hearths were present whether or not we actually uncovered any in our small-to-moderate-scale excavations. An earth oven - a stone-lined pit - requires moderate energy investment that would exceed the investment in a surface hearth. It therefore is assumed to represent a different kind and higher intensity form of food processing than is represented by a mussel shell FCR feature or a surface hearth. Occupations defined by housepits, earth ovens and mussel shell-FCR features, mussel shell and FCR features and surface hearths, are in a descending order of energy investment and activity intensity.

Use-Wear.

The attributes used in the use-wear and faunal dimensions were groups of study area occupations. Membership in the groups was based on similarity in kinds and proportions of tools. Occupations were arranged into use wear groups by inspection and comparison of percentage histograms (Figure 14a, b); the groups are described in Table 15. We attempted to form groups through numerical taxonomy, using the

Table 22. Functional Classification of Occupations

Feature Classification	H.	Pithouse present, other features present or absent
	T.	Shell and fire cracked rock concentrations and earth oven present, no pithouse; hearth present or absent
	S.	Shell and fire cracked rock concentrations with or without hearths and without pithouse or earth oven
	V.	Hearth only
	?.	No features found
Lithic Use Wear Group Descriptions	O_1	Classes 16 (bifacial chipping and crushing on edges), 3 (unifacial chipped convex edges and 19 projectile points) predominate with 3 the most abundant
	O_2	Classes 3, 16 and 19 predominate with 3 most abundant
	A.	Classes 1 (unifacial chipped concave edges), 3 and 19 dominant with type 3 most abundant
	U.	Classes 3 and 4 (bifacial chipped convex edges) and 15 (unifacial chipping and crushing on convex edges) predominate
	I.	Classes 3, 7 (crushing on convex surfaces and edges) and 19 predominant
Fauna Group Descriptions	L.	Turtle, deer and either porcupine or muskrat present, either deer or turtle predominant
	M.	Salmon and deer are predominant elements in all M type assemblages
	M_1	Salmon and deer vastly more abundant than other taxa, with salmon the more common
	M_2	Deer, salmon and turtle predominant, with deer the most numerous and marmot also present in most cases
	N.	Ungulates (deer or sheep) only, or vastly more common than other taxa
	P.	Birds and snakes predominant, may be a natural assemblage

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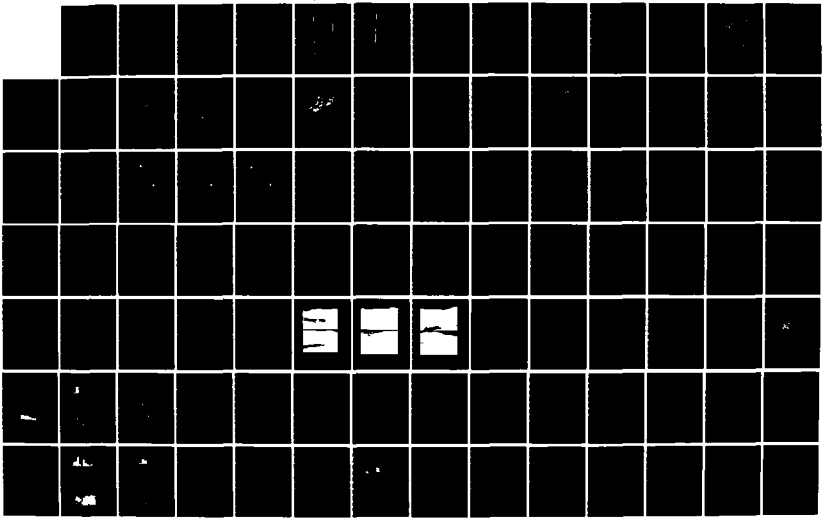

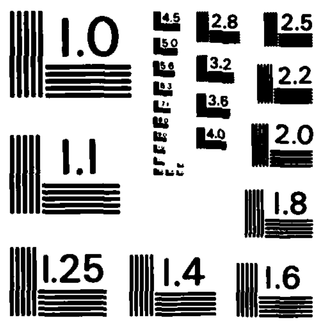

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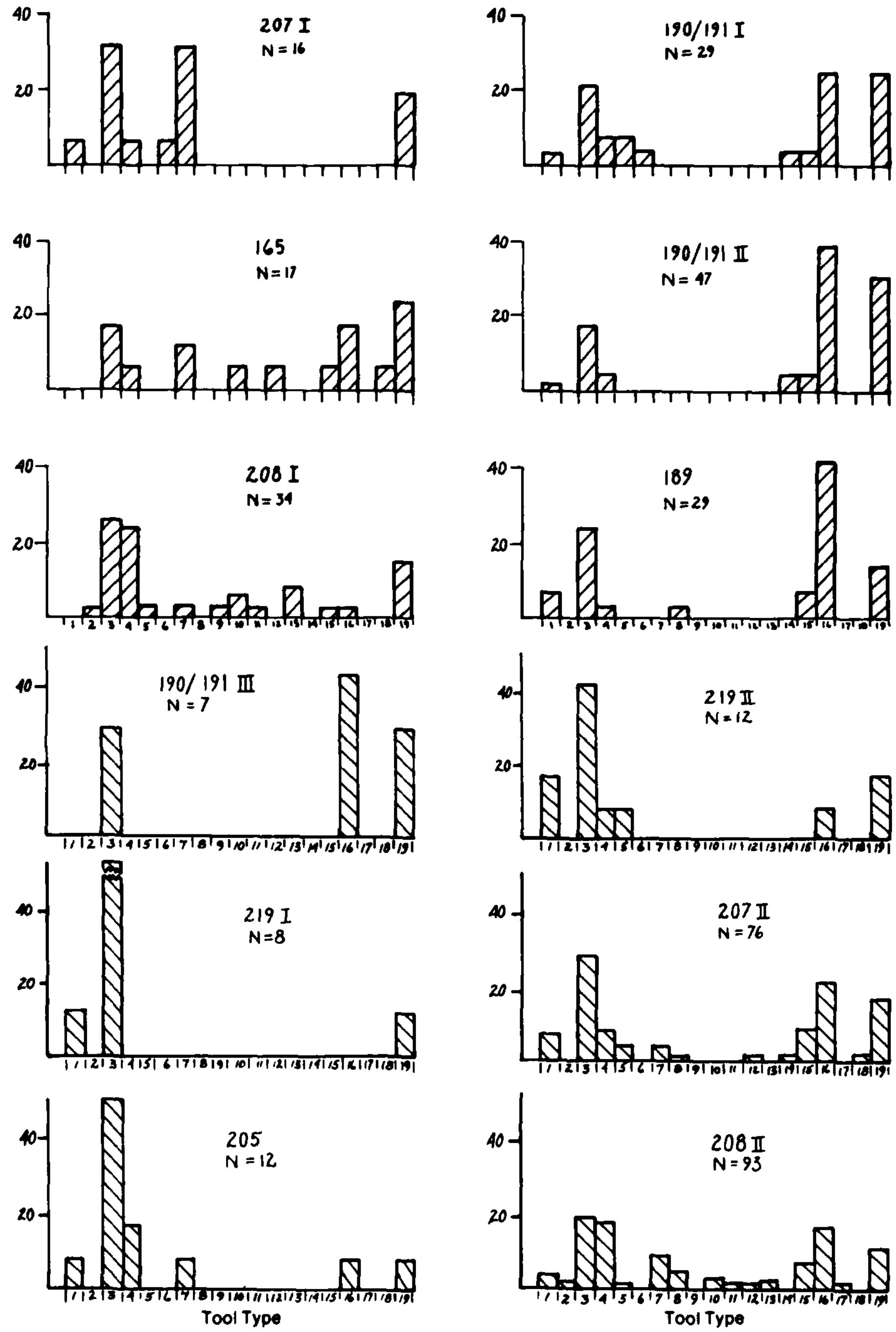

Figure 14(a). Percentage histograms of use-wear based tool classes among the twelve larger occupations at RM 590.

Brainerd-Robinson coefficient of similarity (Brainerd 1951; Robinson 1951), but only housepit occupations contained large enough samples to permit this, and they were all closely similar (Figure 14).

Only occupations with sample sizes greater than or equal to 1/2 the number of tool classes (minimum 8) were deemed large enough to be used in the initial grouping procedures. This was done so that sampling error resulting from small samples would not be the dominant variable in the formation of groups. After groups were formed, another occupation (45DO191 III) was added to an existing group by best fit. The remaining occupations (including all those from 45DO394, Occupation III at 45OK219, and 45OK199) had assemblages too small for placement in groups and remained unassigned

The histograms in Figure 14 show several patterns. Occupations 45DO189, 45DO190/191 I and II, 45OK165, 45OK207 II and 45OK208 II all have high frequencies of the three principal classes (3, 16, 19) and are use wear group O. Occupations 45OK205 and 45OK219 II, both characterized by Tool Class 3, are assigned the designation A. Occupations 45OK207 I and 45OK208 I are both unique (mixing with lower occupations may be partially responsible, but both are unusual in other respects as well, see below) and are the sole occupants of use-wear classes I and U, respectively. None of the remaining occupations, with less than four tools each, could even be assigned to these groups. Table 22 lists group descriptions.

Note that Group O coincided with pithouses in six of seven cases; three of four Group A occupations have no pithouse associated. No unassigned occupation or occupation of use-wear Group I or U occurs with a pithouse.

Fauna

In the case of fauna, we used both numerical taxonomy (average linkage clustering using the Brainerd-Robinson coefficient of similarity) and visual comparison of histograms to devise faunal groups of occupation (Figures 15 and 16a, b). The result was four groups (Table 22). Faunal Group M is dominated by salmonid fishes, deer, and turtle to the near exclusion of all other taxa except some marmots. Non-deer ungulates, beavers, coyotes or dogs, hares, non-salmonid fish, snakes and birds are represented in very low frequency. There were two variants of this group, one in which deer was most abundant (M2) the other with more salmonids (M1). Group N contains ungulates, mountain sheep and deer in all cases, and virtually nothing else. Group L includes an ungulate or turtle as dominant, with the only other taxon being either porcupine or muskrat. Group P is a residual assemblage, unlike all others, with an extremely varied fauna of snakes, birds and coyote or dog, hare, deer, elk and salmonid fish in that order of abundance.

Results.

The three dimensions described above formed the basis for the classification of settlements (Table 23). Settlement classes represented among our occupations are: HOM, housepit occupations with tools 3, 15, and 19 predominating and salmonids, deer and turtle the most common animals represented; HAM, similar but with low frequencies of tool 15; SOL non-housepit occupations with shell features but no ovens, tools 3, 15 and 19 and deer, turtle and muskrat/porcupine the only fauna; SIN and S-N*, non-house occupations with shell features but no earth ovens, small tool inventories or tools 3, 5 and 9 most frequent and ungulates the only or primary animal taxon present; and TUL, a non-pithouse site with shell

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*Note SIN and S-N are combined on the basis of occupation feature class S and faunal group N. S-N members have tool samples too small to group.

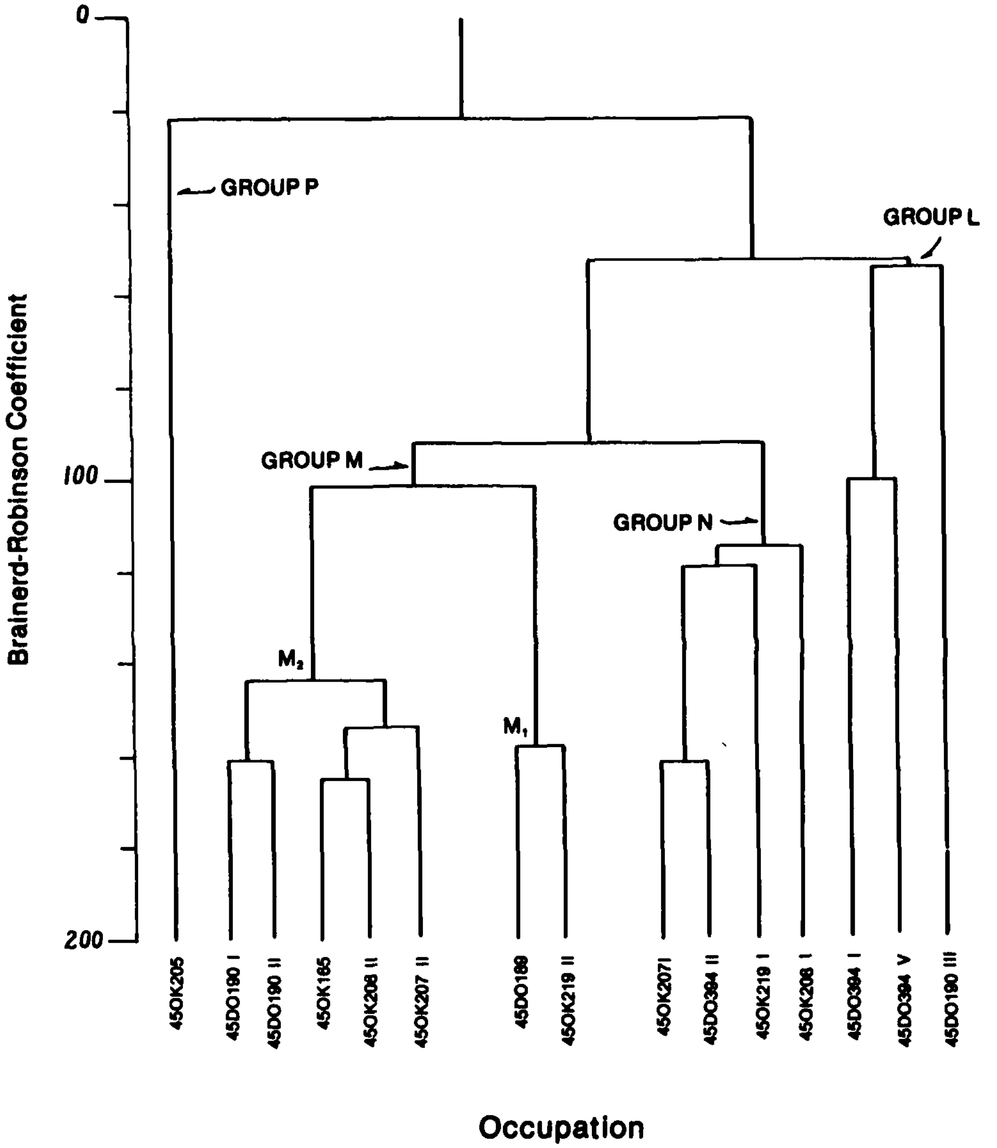


Figure 15. Dendrogram showing results of average linkage cluster analysis of RM 590 faunal assemblages.

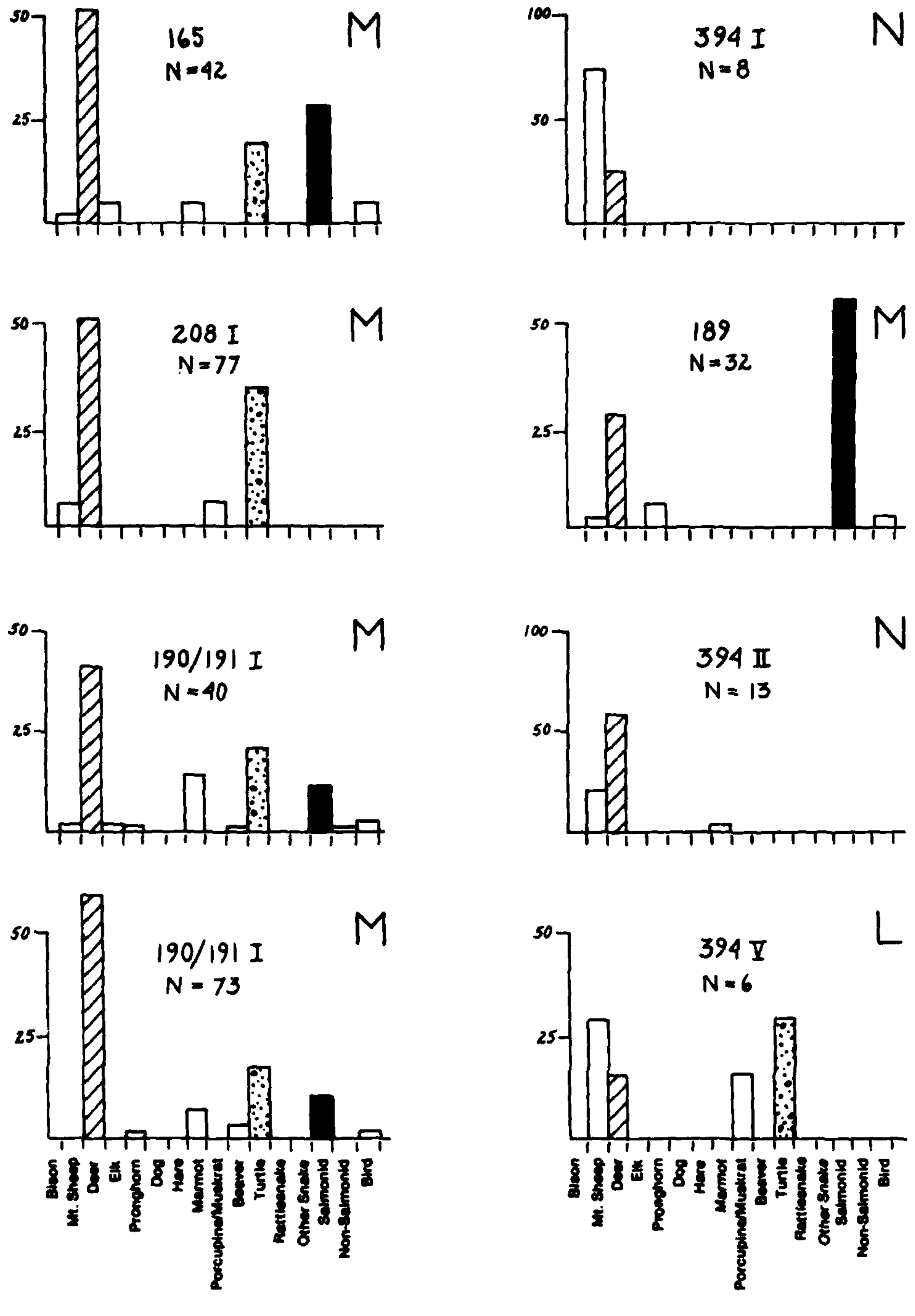


Figure 16(a). Distributions of faunal taxa among study area occupations.

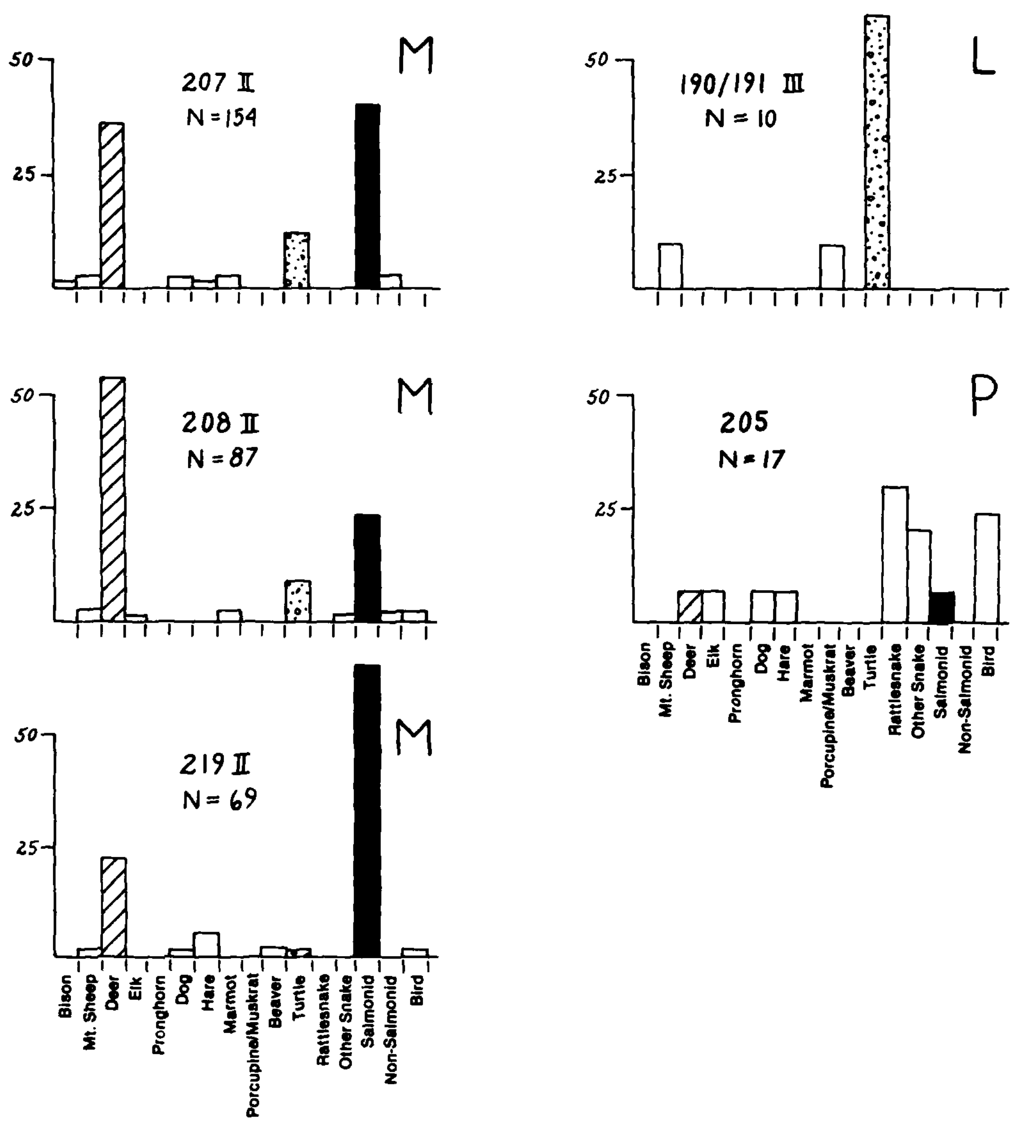


Figure 16(b). Distributions of faunal taxa among study area occupations.

and FCR features and an earth oven; tools 3, 4 and 19 and ungulates, porcupine/muskrat and turtle the only common fauna.

Seasonality

To understand the adaptation of a human population, we must not only know how it distributed its activities in space and which resources were being utilized in each kind of environment, but also know when parts of the environment were visited to gather each resource. Adaptations to both environmental and technological changes can alter the time-space relationship between people and resources; thus seasonality (the temporal aspect of ecological niche) is an important component of settlement patterns.

Table 23. Settlement Classification of RM 590 Occupations.

Period	Occupation	Feature	Lithic	Fauna	Class
	45OK207I	S	I	N	S-N
IV	45OK165	H	O	M	HOM
	45OK208I	T	U	L	TUL
	45DO190/191I	H	O_1	M	HOM
	45DO190/191II	H	O_1	M	HOM
	45DO394I	S	-	N	S-N
III	45DO189I	H	O_1	M	HOM
	45DO394II	S	-	N	S-N
	45DO219I	?	A	-	--?
	45DO394III	V	-	-	--?
	45DO394IV	S	-	(N)	S-N
	45DO394V	S?	-	L	S-L
	45OK207II	H	O_2	M	HOM
II	45OK208II	H	O_2	M	HOM
	45OK219II	H	A	M	HAM
	45DO190III	S	O_2	L	S-L
I	45OK205	(S)	A	P	SAP
	45OK219III	-	-(A?)	-	---

Monks (1981) recently has synthesized current approaches to the study of seasonality, which are derived from the analysis of plant and animal remains. Seasonality may be determined by the presence of animals available to people during only part of the year (e.g., migratory fish and fowl, hibernating mammals); presence of seasonal growths (such as antlers); growth patterns (in wood, shellfish, fish and reptiles) or reproductive parts (seed, flowers, pollen); and animal ages (judged through epiphysial fusion, tooth eruption and wear in mammals, ossification of joints in birds). Where these materials are not available, ethnographic analogy must be used, with all its deficiencies (cf., Dunnell 1978; Hayden 1978).

We were rarely able to assign an occupation to a specific season or seasons using anything but analogy. Most of the fauna found in our sites (ungulates, hares, dog/coyote, porcupine, beaver, muskrat, non-salmonid fish and ground birds) are active in the area year-round.

Salmon are anadromous and snakes, turtles, and marmots hibernate and might be good seasonal indicators were it not for cultural practices extending the seasonal availability or at least consumption of most of them.

Both salmon and marmots were preserved by smoking and drying (Ray 1933; Elliot, 1914) and stored for winter consumption. These species thus become equivocal indicators of season, especially in semi-permanent housepit occupations. At small, temporary campsites, however, it is more probable that animals occurring in site deposits were obtained during habitation at the camp rather than having been brought in as stored food. At least we will make this assumption in determining site seasonality from the presence of marmot remains (salmonid bone occurred only in housepit occupations). Marmot are active and available from early spring to late summer (Bailey 1936), although in other seasons they might occasionally have been excavated from their talus slope dens by hungry, diligent individuals. Several S-N class settlements contained marmot and may, thus represent spring or summer seasons.

Snake and turtle are active during warm seasons and should be good indicators of non-winter occupancy of sites. However turtle carapaces may have been curated as bowls, rattles or boxes and seem to be an unreliable indicator of seasonality. We found snake remains in quantity only at site 45OK205, which thus probably represents a non-winter occupation.

For all other sites we were left with animal ages and seasonal structures (specifically tooth eruption in deer - the only species for which mandible fragments occurred in any frequency), foetal deer, and deer antler growth. Only one deer skull, with antlers fully formed (45DO191-II) and one foetal deer (45DO190-I) were found; deer mandibles are all very fragmentary and have not been studied.

Based on the scheduling of gestation and antler development in deer (Taylor 1956), we conclude that 45DO190/191 II was at least an October-March occupation; 45DO190/191 I was used at least during March to May. Both are evidently winter season habitations; both are HOM settlements.

Because we had so few indicators of seasonality that weren't in some sense equivocal, we were able only to suggest the scheduling of site occupancy using faunal remains; ethnographic data, which identified housepits as representative of winter/year-round base camp occupancy, had to be used in most instances.

CHAPTER X

ENVIRONMENTAL RECONSTRUCTION

We have used sedimentological data from RM 590 in conjunction with numerous other geologic, palynological and zooarchaeological studies, to devise a reconstruction of paleoenvironmental events for the Columbia Plateau, with a focus on the Chief Joseph Dam Project Area. We begin with findings from this project, which are geologically derived, and follow with an integrated history of the regional environment. With this completed, we have data on selective pressures impinging on local human adaptations from the biophysical environment and, in the final chapter, consider the evolutionary impact of environmental events on adaptive strategies.

Paleoenvironmental Change as Interpreted From RM 590 Sediments

Through our test excavations, we obtained two kinds of information that are usable for the study of paleoenvironments: (1) geologic stratigraphy and geomorphology and (2) faunal remains. Our primary source of paleoenvironmental data is the careful study of site sediments, from which we infer changes in river base levels, ground water levels, floodplain development and erosion. We do not use faunal remains for paleoenvironmental reconstruction in this study. Human beings are selective of those species they exploit, and changes in the presence of animals in archeological sites may reflect changes in human behavior not correlated with changes in the presence or distribution of those animals in the natural environment (Chatters 1982; King and Graham 1981; Rice 1975). Environmental changes indicated by faunal remains must be corroborated with independent evidence, unless changes are of a magnitude that cannot occur without the wholesale alteration of local habitats.

Erosion of Nespelem Silts and Formation of the Upper Terrace (T2 and T3) Levels: Prior to 6700 BP.

Following deglaciation of this area, the glacial-outwash swollen Columbia River quickly incised its way through the compacted but unconsolidated glacio-lacustrine silts of the Nespelem Formation (TSU 1). Rapidly flowing along a steep gradient, the river probably had a braided bed of constantly shifting channels and mid-channel bars (much like that suggested by Meirendorf [1983] for the coeval Kootenai). Evidence of this braiding channel occurs at 45OK219, wherein a sand-filled, abandoned channel lies between the base of the slope from T4 terrace and a lens of fluvial gravel through which the Columbia subsequently has cut. Either as the Columbia's flow became reduced and side channels were abandoned and ceased their downcutting or because of temporary rises in the river's base level, the river cut a series of terraces before forming its present channel.

Aeolian Deposition and Low River Levels: Pre-6700 to 4700 BP.

Sediments of this period consist of gray-brown to light-brown loess deposited on higher (T2, T3) terrace levels. There is no evidence of floodplain aggradation during this period (see below), so the loess probably derives from either silts eroded from the Nespelem Formation as the Columbia continued its downcutting or it was blown in from regional sources. Hibbert (n.d.) suggests that the Columbia River had reached a level near its modern bed by 10,000 BP; discoveries of artifact assemblages older than 6000 years near the Columbia's modern level (Crozier 1983; Grabert 1968; Hartmann, 1983) supports his assertion. It is unlikely, therefore, that loess deposits on T2 and T3 levels in the Study Area are derived from the local Nespelem Formation.

Hammatt (1977) reports similar loess formations on the lower Snake River, interpreting them to be the result of wind erosion and redeposition from a largely unvegetated land surface resulting from a lowered water table. In the absence of evidence for a floodplain source for this loess at RM 590, we follow Hammatt's interpretation.

Our evidence suggests generally low river levels (although infrequent flash flooding is quite possible, as Crozier [1983] suggests) and a largely unvegetated environment.

Soil I and Stability: 4000-5000 BP.

The development of Soil 1, with a shallow, calcium and silica rich B horizon, indicates surface stability under semiarid conditions (Buol et al., 1973). The cooling episode that occurred around 5000 BP (Denton and Karlen 1973) may have resulted in stabilization of the land surface and the development of Soil 1 (cf. Hammatt 1977).

Aggradation Begins, 4700-4500 BP.

The inception of floodplain aggradation at 4500-4700 years ago, as indicated by low-bar sands and river bed gravels in 45DO190/191, marks the onset of moister conditions that pollen influx and Snake River aggradation also indicate (Hammatt 1977). As more water flowed down the Columbia and its tributaries, hydraulic damming might have occurred, raising the river's base level on a year-around basis. Raised water levels and bed levels seem to have slowed the stream; the differential age of low-bar sediments at 45DO190/191 and 45DO394 indicate long wave lateral "migration" of the Columbia, at least between 3500 and 4700 years ago. Aggradation continued to build the floodplain up to 3m above annual flood levels. We interpret the brown T.S. Unit XIc loess as the wind transported fine fraction of fluvial silts and fine sands deposited frequently on the T1 level and subject to wind action until plant cover redeveloped and prevented further movement of sediment.

Alluvial Fan Building After 2500 BP.

Not long after 2500 BP, with the end of aggradation, came a series of severe flash floods, eroding older sediments near the mouths of small streams (45OK208 and 45OK165) and beginning deposition of alluvial fans. The two events may both be related to an overall drying and warming of the environment. Reduced flow in all streams would drop the Columbia's base level; reduction in ground cover and exposure of upland soils to erosion would accompany drying. The phenomenon first results in renewed downcutting and lowering of flood levels and the second allows for the erosion, transport and deposition of sediment onto fan surfaces.

Summary.

Our sedimentary evidence suggests that the riverine environment in the RM 590 vicinity has changed from a broad, braided stream (prior to 6700 BP) to a low stream not subject to extremes in annual flooding, but prone to catastrophic flash floods between over 6700 and 4700 years BP,

then to a high water stream with a widened floodplain between 4700 and 2500 BP and, finally to the downcutting stream observed historically.

Climatic conditions indicated by this sequence include aridity to 5000-4700 BP, increased moisture between 4700 and 2500 BP and the return of dryer conditions after 2500 BP.

Environmental Reconstruction: A Summary

Palynological studies (e.g., Mack et al. 1976, 1978a, b, c, 1979; Dalan 1979; Nickmann and Leopold n.d.) and investigations of Holocene geology (e.g., Fryxell and Daugherty 1963; Fryxell 1963; Hammatt 1977; Marshall 1971, this volume) demonstrate that the modern Columbia Plateau environment has been in existence for no more than 2000-2700 years. Large-scale physiography has remained constant, certainly, but the hydrology and depositional environment of the river and the distribution and content of plant communities have both changed markedly during the period of human occupancy of the upper Columbia River. Therefore, to attempt an understanding of prehistoric human adaptive strategies and of the processes of change in those strategies using an unchanging environmental model based on modern plants, animals, climate, and hydrology is likely to result in spurious statements about regional prehistory.

The reconstructions we offer here, and which are illustrated in Figures 19 to 23, are inferred from three principal classes of data: (1) pollen records, (2) stratigraphy and geomorphology of the Columbia and Snake River canyons, and (3) the sequence of Holocene temperature changes as inferred from the history of montane glacial activity. Figure 17 shows the locations of sites and areas discussed below.

Eight well-dated pollen records are available for study (Figure 18). Creston Fen (Mack et al. 1976), Williams Lake Fen (Nickmann, 1979), Goose Lake (Dalan, 1979; Nickmann and Leopold, n.d.) and Simpson's Flats (Mack et al. 1978a) are now located in the steppe-conifer forest ecotone. Bonaparte Meadows and Mud Lake (Mack et al. 1979), Big Meadow (Mack et al 1978b) and Hager Pond (Mack et al. 1978c) are currently situated within various conifer forest communities. Two other records were unsuitable: Waits Lake (Mack et al 1978d) has dating problems and cannot be cross-dated with other sites, and Kelowna Bog, in southern British Columbia (not shown) appears to us to represent a successional sequence rather than a record of regional environmental change, at least in its earlier levels (Alley 1976a). Summary vegetation histories (usually oversimplified in the interest of brevity) are presented in chart form (Figure 18), arrayed according to their positions relative to the maximum extent of Vashon ice and to the date of their deglaciation. Creston and Williams Lake Fens filled basins left by the catastrophic Missoula floods, which occurred repeatedly during the Fraser glaciation (Bretz 1959, Richmond et al. 1965). Neither area has ever been glaciated and both thus provide insight into the late glacial flora of eastern Washington. All other sites were glaciated and are presented, from left to right, in the order of their exposure and availability for pollen deposition.

In presenting the reconstructions that follow, we have made use of the interpretations of the original investigators. However, we also employ pollen influx data from those sites where gross pollen deposition rate data either has been (Mack et al. 1978b, c, 1979) or can be (Nickmann 1979) corrected for variations in sedimentation rate, and therefore actually may provide a record of pollen production by plants. Chatters (1982a) has presented evidence that increases in pollen influx rates in Bisonsweh Pond, Idaho coincided with the onset of a more mesic climatic interval that began around 600 BP and declined when drier conditions returned some 300 years later. He also noted that pollen influx rates for all plants rose and fell independently of changes in

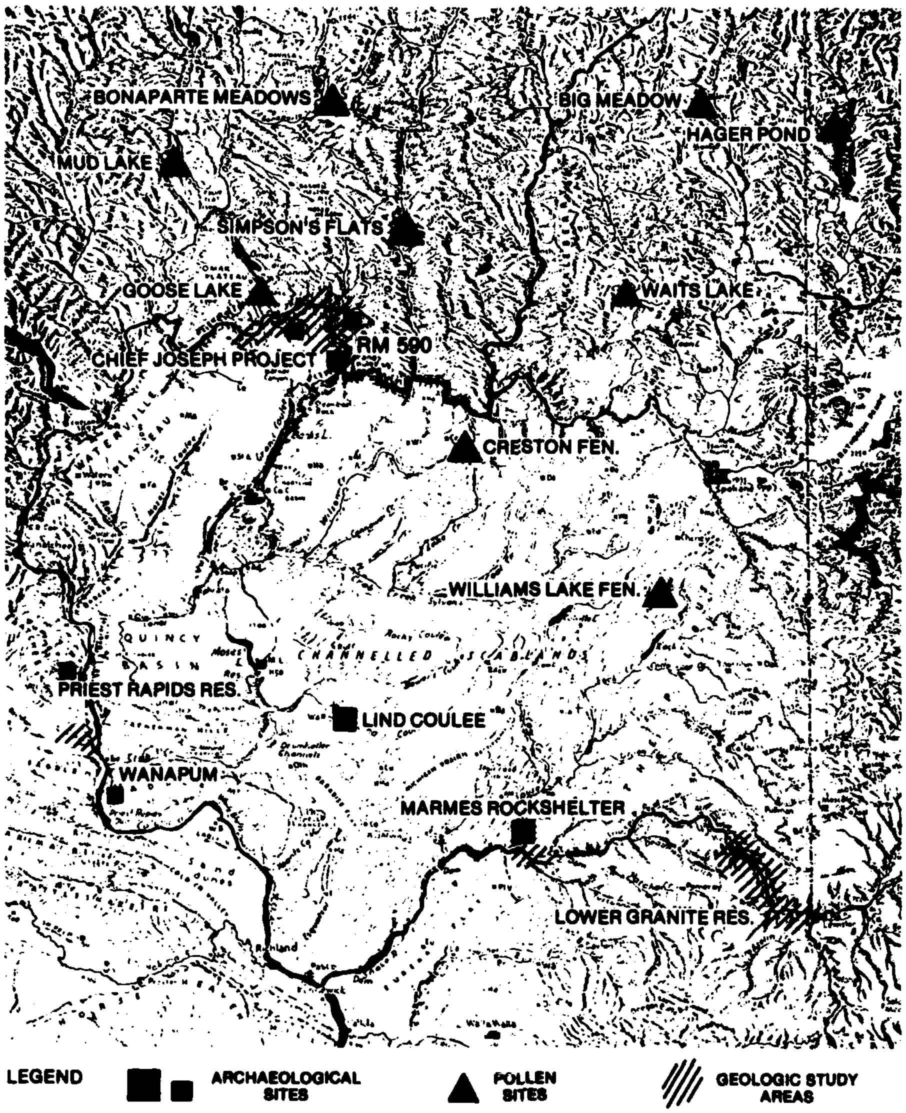
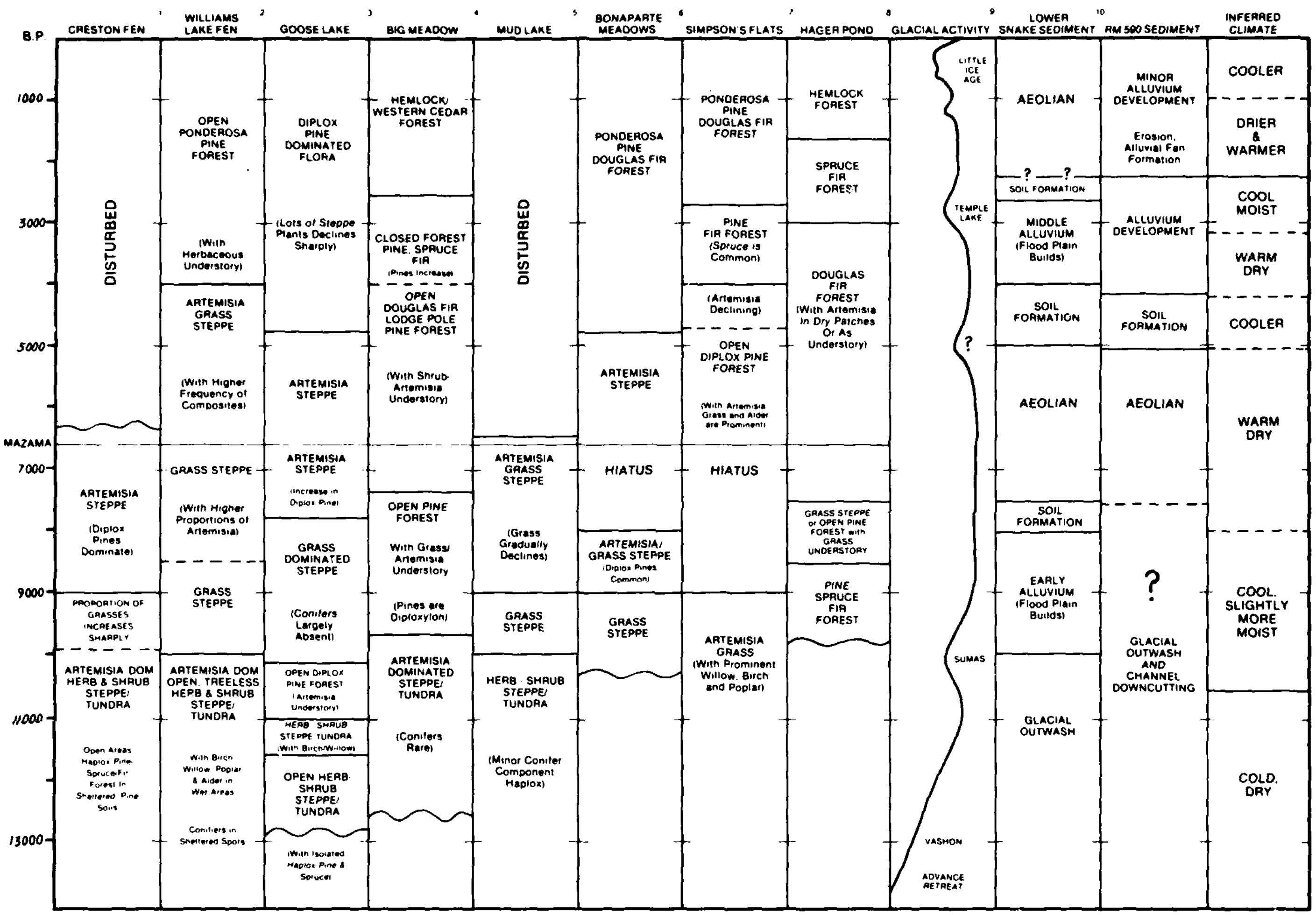


Figure 17. Location of palynological and archaeological sites and geologic study areas mentioned in the text.



1 Mack et al. 1976
2 Nickmann 1979 Williams Lake Fen
3 Nickmann and Leopold n.d. Goose Lake
Dalan 1979 Goose Lake
4 Mack et al. 1978b
5 6 Mack et al. 1979
7 Mack et al. 1978c
8 Mack et al. 1978a
9 Denton and Karlen 1973
10 Hammat 1977

Figure 18. Location of palynological and archaeological sites and geologic study areas mentioned in text.

the species composition of plant communities. The latter were contingent on changes in both moisture and temperature components of climate. Thus, pollen influx rates are assumed here to represent the relative pollen production of plants which in turn is responding most rapidly to moisture availability. A sudden rise or decline in influx rates will thus be taken as an indication of rapid changes in regional precipitation.(1)

The glacial history prescribed in Figure 23 is derived primarily from summaries of late Quaternary geomorphology (Easterbrook 1976; Richmond 1965; Richmond et al. 1965) and late Holocene neoglaciation (Denton and Karlen 1973; Mahaney et al. 1981), and has been partially corroborated with information from southern British Columbia (Alley 1976; cf. Duford and Osborne, 1978), and the northern and central Cascades (Crandell and Miller 1964; Miller 1968). Geochronology of the Snake River was outlined in the excellent study by Hammatt (1977), but no similar chronology has yet been worked out for the Columbia prior to this report (although Cochran [Carlevato et al. 1982] and Meirendorf (1983) are working on the Wells and Rocky Reach Reservoir areas respectively and Crozier [1983] on the Chief Joseph). The tentative sequence of geologic events on the upper Columbia presented in the of Figure 23 is based in part on unpublished work of the University of Washington CJDCRP and the late Pleistocene geochronology described by Hibbert (1980) and Kiver and Stradling (1982) and on our own findings during this project.

Late Glacial Conditions: 13,000-10,000 BP (Figure 17).

By 13,000 years ago, glaciers of the Vashon Stade had begun to melt. Large masses of wasting ice lay over the Okanogan Plateau and a massive ice dam choked the deep, narrow Columbia River canyon between Omak Trench and the mouth of the Okanogan River, creating glacial Lake Columbia (Hibbert 1980). The retreating glacial front then lay somewhere north of the Columbia and Okanogan Rivers, but had not yet receded north of Tonasket, Colville and Priest Lake. Although global temperatures had begun to rise, the climate was still cold and arctic conditions were perpetuated locally by the presence of thousands of square kilometers of ice. Soils of the Waterville Plateau eastward into the Spokane and Cheney areas were still in permafrost.

There was a single plant community throughout the northern and eastern parts of the Columbia Basin (and probably the southern Basin as well; cf. Gustafson 1972) and all along the Rocky Mountain Cordillera to beyond Yellowstone Park (Waddington and Wright 1974; Mehringer et al. 1977). A cold-adapted form of Artemisia (sagebrush) dominated this nearly treeless steppe/tundra environment. Scattered groves of haploxylon pines (probably either whitebark or limber pine), spruce and fir inhabited sheltered sites, away from the cold, drying winds and root-damaging effects of permafrost (Mack et al. 1976). Birches and

(1) There are problems with this form of inference, to be sure, which can be grouped into three general statements "(1) no simple relationship exists between the absolute abundance, biomass or proportionate abundance of a plant species and its pollen production; (2) the relationship between pollen production and the influx of pollen grains to a depositional site is complex and not entirely controlable and (3) the relationship between the concentration or proportional representation of pollen types in a core sample and the concentration and proportionate abundance of those same types in the total population of pollen in the depositional site is also complex and only partially understood" (Chatters 1982a:341). If various factors such as the structure of the pollen site, the plants immediately surrounding the site and the differences in pollen production between species can be held constant, then pollen influx data can be used with some degree of onfidence. However, these variables have not all been controlled for in the studies discussed here, and we infer precipitation changes from pollen influx with extreme caution. These data are only used as support for climatic inferences from regional geomorphological evidence.

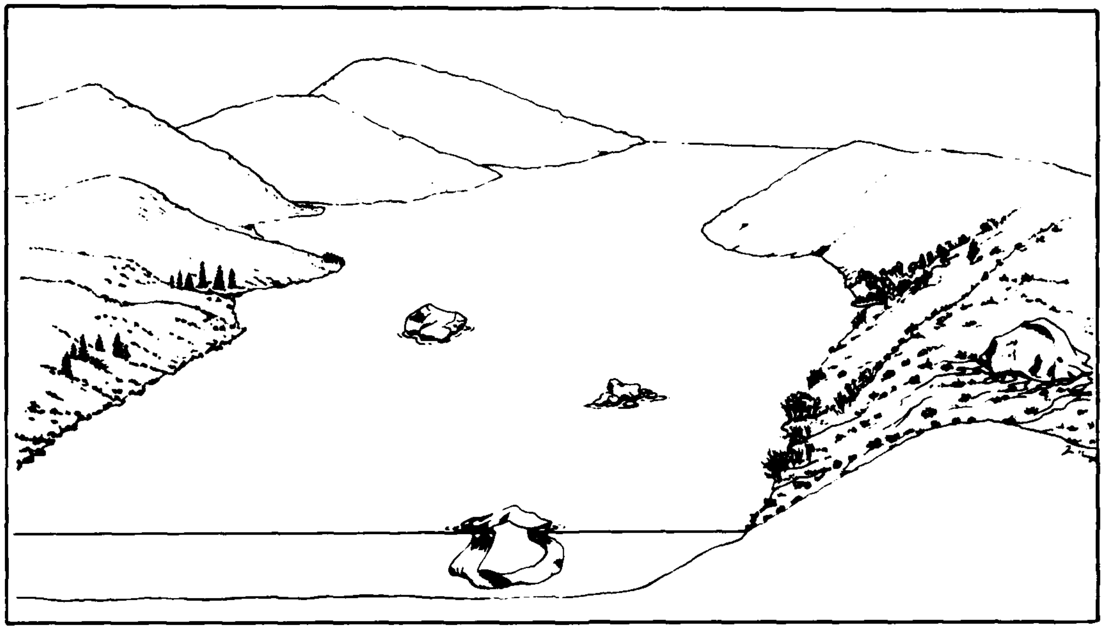


Figure 19. Reconstruction of the landscape in the RM 590 vicinity, circa 13,000 BP. Note the largely treeles environment.

willows grew in wet areas along streams and around kettle lakes, sloughs and the many other wetland environments left by melting glaciers and catastrophic flooding. Pollen influx for this period is usually quite low, leading investigators to suggest that vegetation was sparse (Nickmann and Leopold n.d.).

We know little about the animals in this ecosystem, especially for the earlier part of the period. Certainly there are mammoths, for their huge, readily-recognized bones have been unearthed throughout the Columbia Basin (Lyman n.d.). Extinct forms of bison (Kirk and Daugherty 1979) and elk (Gustafson 1972) also were present. Arctic fox, a tundra species, and the pine marten, both found in a single stratum at Marmes Rockshelter on the Snake River (Gustafson 1972), give further evidence of the mosaic of plant communities present during this time.

By the end of this period, stagnant ice masses had melted away, and the glaciers had receded far into Canada (Fulton 1971). The ice dams in the Columbia's canyon continued to melt and, as Lake Columbia was lowered, the meltwater-swollen river eroded its way through lake-bed silts, the regional climate began to warm (cf. Denton and Karlen 1973).

Human beings arrived in the area during the end of this period (Fryxell et al. 1968).

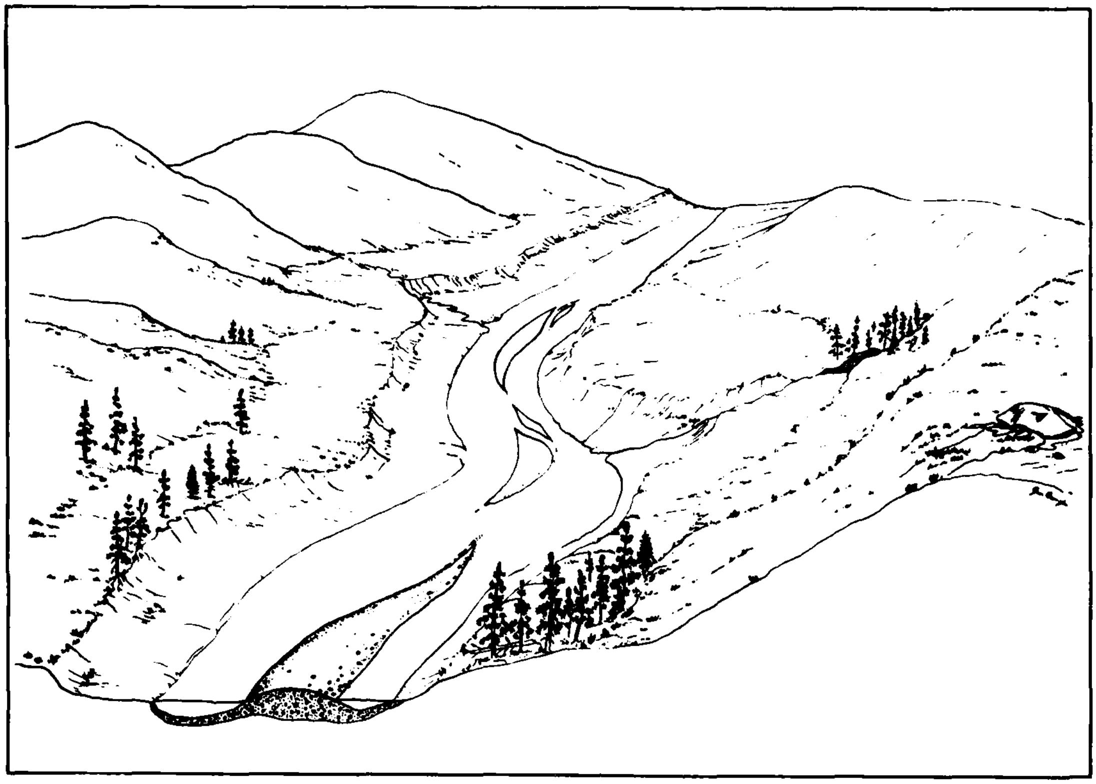


Figure 20. Reconstruction of the landscape in the RM 590 vicinity, circa 9500 BP. Note scattered patches of conifers in protected settings.

Early Post-Glacial Grasslands and Forests: 10,000 to 9000 BP (Figure 18).

By this time, glacial ice remained only in isolated parts of British Columbia and in high mountain cirques (Fulton 1971). The Snake River was no longer scouring its channel and had begun to aggrade, building a floodplain well above its modern flood stage (Hammatt 1977). The Columbia River, however, at least in the Study Area, was still scouring, cutting the last of its erosional terraces en route to its modern channel. Cochran (personal communication) suggestd that floodplain aggradation was occurring below the Okanogan River mouth and in the lower Okanogan Valley.

Plains and low mountains as far north as Tonasket and east into the Colville Valley (Mack et al. 1978d) supported grasslands. An open diploxylon pine forest (probably lodgepole pine) with a grass understory grew in extreme northeast Washington; the forest near Priest Lake was made up of a cold-adapted spruce fir and haploxylon pine (probably whitebark or western white pine). Little is known about the flora of the southern and western Columbia Basin, but the abundance of elk in the remains of archaeological sites of this period (Gustafson 1972) suggests the presence of at least some open forest.

Warming and Drying Begin: 9000 to 8000 BP (Figure 19).

Glaciers were now completely gone, even in most high mountain areas (Duford and Osborne [1978] suggest a minor glacial advance at this time in the Shuswap Mountains, but they have no firm date for this event as yet). The Snake River continued aggrading its floodplain during the early part of this period, and the Columbia was making its final cut toward bedrock and the modern river channel. Everywhere, pollen records show evidence of a drying climate. Sagebrush and other xerophytic (dry-adapted) plants became increasingly abundant in the grasslands, while in already open forests, clearings became larger. The spruce-fir-pine forest of the Priest Lake area gave way to an open pine community with grass understory, or perhaps grassland with scattered trees.

Bison were still present in the central Columbia Basin (Irwin and Moody 1978) attesting to good grass cover in that area. Many wetlands remained in ice kettle basins and coulee bottoms. Salmon were present in the Columbia and had begun spawning above Kettle Falls (Chance and Chance 1977).

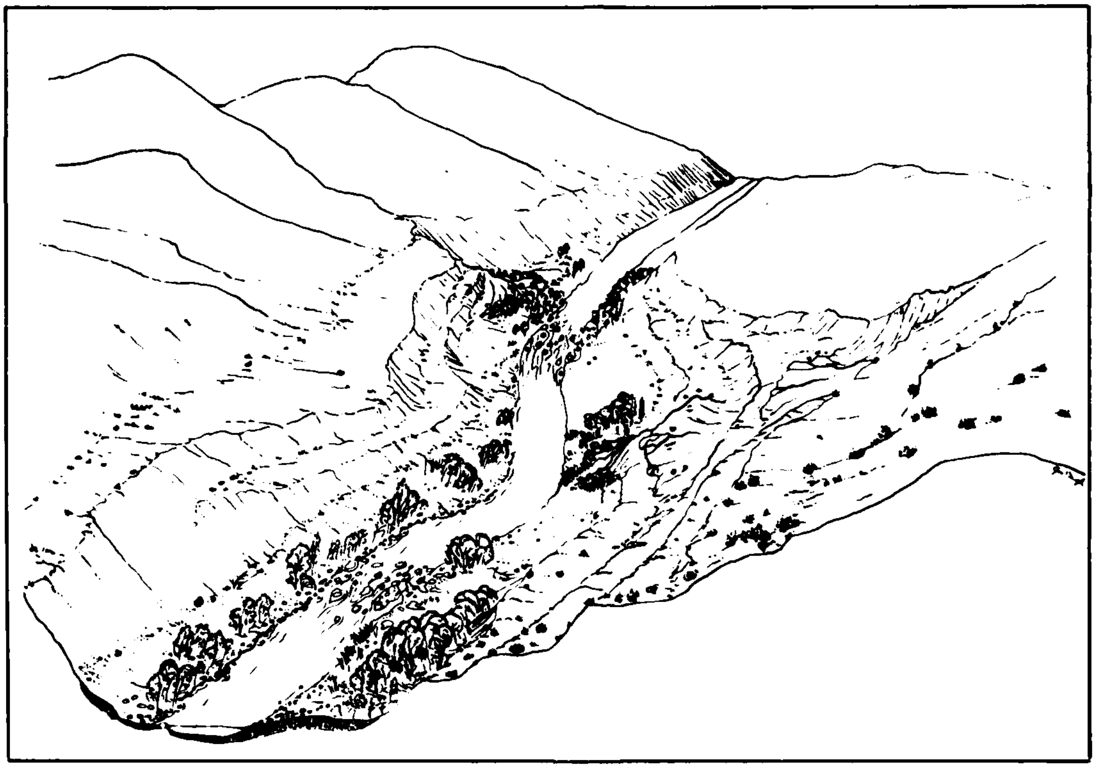


Figure 21. Reconstruction of landscape in the RM 590 vicinity, circa 6000 BP. Note the lack of conifers and low growth of riparian brush.

Maximum Aridity: 8000-7000 to 4700-4000 BP (Figure 19)

Glaciers were virtually nonexistent in North America during this time. (cf. Alley 1976a, for a possible exception). Aggradation of the Snake River floodplain had ceased and wind became the primary agent for sediment deposition. Conditions on the upper Columbia at last were similar to the Snake, with a low river flowing across a wide, gravelly bed; annual flood levels were low and aggradation was minimal to nonexistant. Here, too, wind was a major depositional agent. Many of the smaller streams in the Columbia Basin and adjacent hills had become intermittent, and were subject to flash flooding, building broad, steep alluvial fans over terrace surfaces (Hibbert 1980).

Artemisia, probably the common big sagebrush, dominated the steppes, and xerophytes like saltbrush and many annual and perennial composites had become common. This sagebrush steppe, restricted today to drier areas from the central and western Columbia Basin southward, extended during this period far into the Okanogan Highlands, the Colville Valley and eastward into the Rocky Mountain foothills. Although we do not yet have pollen records for the southern and western portions of the Columbia Basin, those areas must have been extremely arid, with sparse vegetation cover of only the most xerophytic kind.

Over much of the area, arboreal vegetation, and open water probably were restricted to the banks of larger streams (and in the hills some cool, north slope habitats), which formed linear oases in an otherwise largely barren ecosystem.

In northeastern Washington and in the Rockies of northern Idaho, as far south as Lost Trail Pass (Mehringer et al. 1977), vegetation was open Douglas fir and pine forests, with sagebrush a common understory dominant.

A Return to Moister Conditions: 4700-4000 to 2700-2500 BP (Figure 20)

The climate became moister sometime after 4700 BP. The timing of this event varies from pollen site to pollen site, perhaps due in part to the vicissitudes of radiocarbon dating. There is however, a pattern to the change, which begins at around 4700 BP at sites in the Okanogan Highland and Omak Plateau, but is not evident farther east until 4000 BP. The climatic shift is signaled at several sites (Bonaparte Meadows, Simpson's Flats, Goose Lake) by an abrupt change in frequencies among various pollen types and, by inference, changes in the proportionate populations of plant species. At other sites (Big Meadow, Hager Pond) there is a sharp rise in pollen influx rates and, again by inference, increased productivity or density of the existing plant community. Both changes occur simultaneously at Williams Lake Fen.

Floodplain building began again around 4000 BP on the Snake River and 4500 BP on the upper Columbia. It continued until sometime between 2500 and 2200 years ago, forming a low terrace on both river systems.

During the latter part of this interval, from around 3300 to 2500 BP, montane glaciers advanced in the Cascades, southern British Columbia, the Wallowas and the Rockies, some reaching their maximum Holocene extent. Thus, it appears that this interval began with increased precipitation, and later became cooler as well.

On the fringes of the Columbia Basin, around Goose Lake and Williams Lake Fen, pines invaded sagebrush steppes creating the open forests characteristic of those areas today. Farther to the north and northeast, open forests had become denser and cold-adapted fir and spruce were more common, especially later in the period.

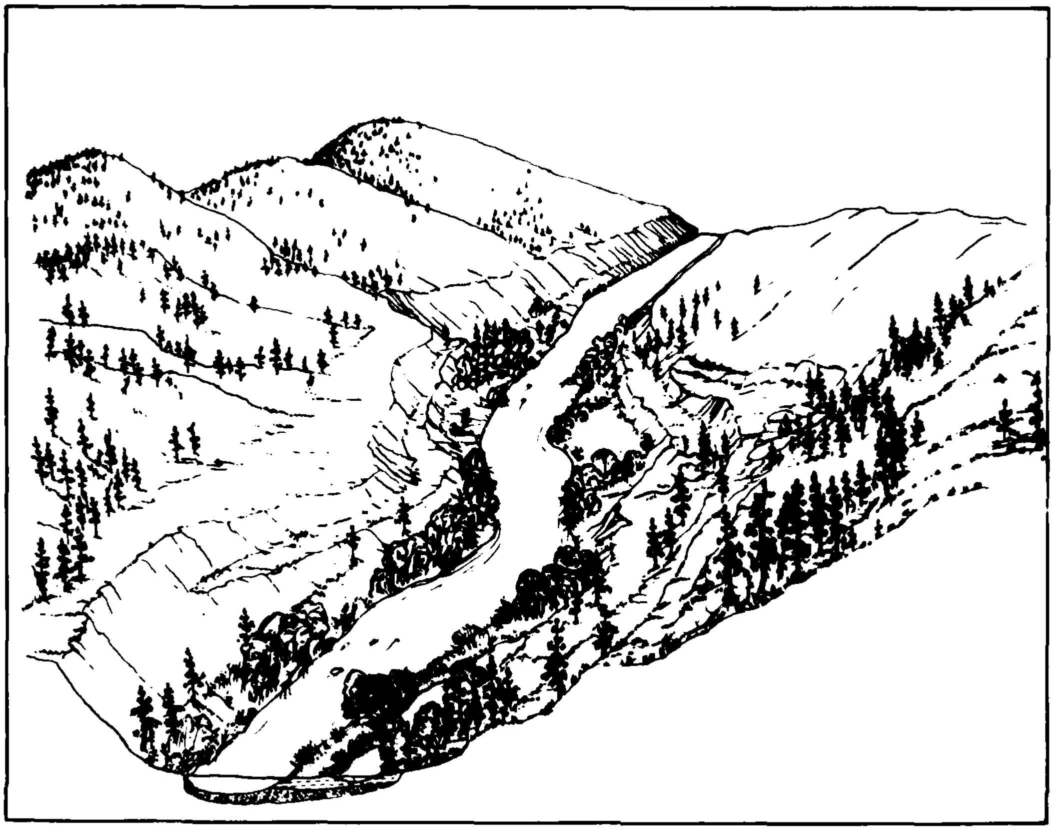


Figure 22. Reconstruction of landscape in the RM 590 vicinity, circa 3000 BP. Both conifer and riparian woodlands have expanded. Note also the broadened floodplain and raised river level.

Riparian environments, at least on the upper Snake and Columbia Rivers were changed markedly. We suspect that, with cooling, moister conditions, conifers migrated into the river canyon, living in scattered groves among various riparian species and dotting both north and south slopes of canyons. The floodplains were now wider, with deep, sandy soils being replenished frequently. With increased river flows, a greater bed load, and apparently a higher base level (less-steep gradient of flow) the river's bed became raised. The river then migrated slightly across its floodplain, constantly eroding its banks in some areas and depositing new sediment as point bars in others. Sands and silts of the point bars constantly were being reworked by the wind, forming dunes along the river's banks. High water and sediment covered many smaller rapids, and the river was quieter.

Because the river's base level was higher, and waters moved more slowly, we postulate a higher water table beneath the broad floodplain, favoring the growth of floodplain forests of conifers and/or woodlands of deciduous brush and trees.

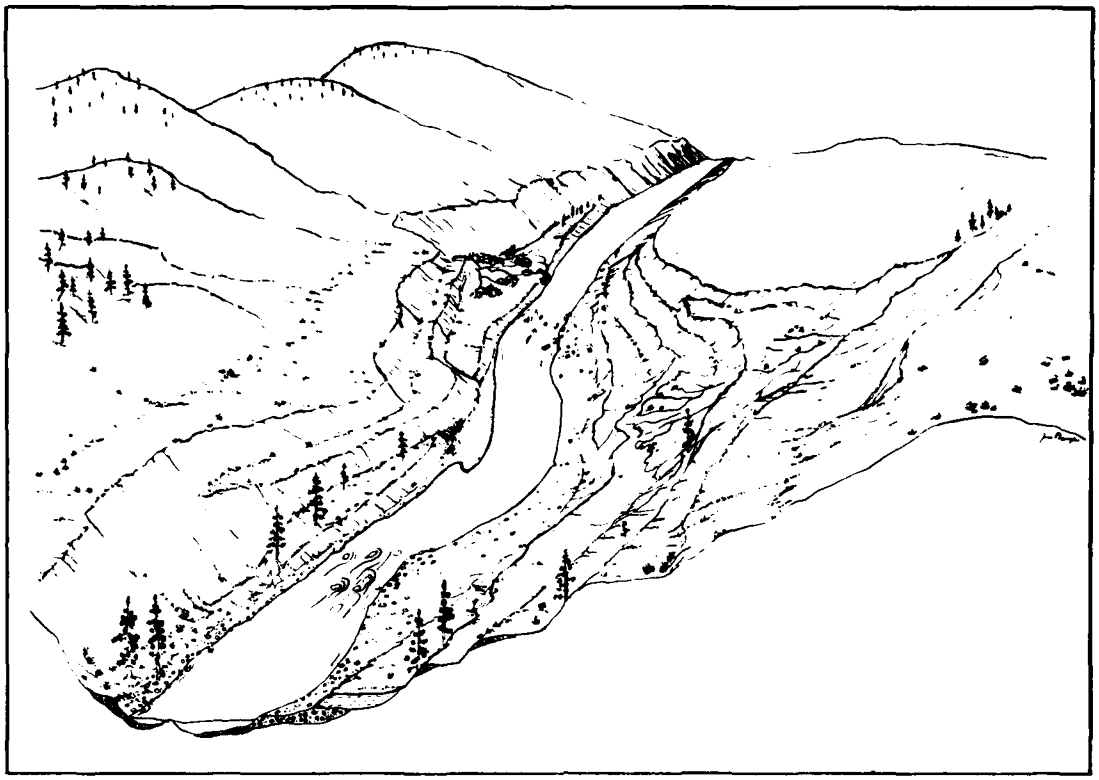


Figure 23. Idealized conception of the historic environment around RM 590. Forests have receded northward and the broad riparian zone of the previous period (Figure 20) no longer exists.

Modern Environments 2500 BP to Euro-American Settlement (Figure 21)

Both the Snake and Columbia stopped aggrading their floodplains by 2500 BP and returned to downcutting. Montane glaciers receded and there was a sharp decline in pollen influx at several sites. Together, these facts indicate a slight warming and drying of the regional climate.

Vegetation communities everywhere evolved into their modern forms. Except for the changes in pollen influx, possibly meaning a decline in vegetation densities, most pollen sites on the fringes of Columbia Basin register little change. However forests in which spruce and fir had become abundant reverted to a more warmth-adapted association of either pine and Douglas fir (Okanogan Highland) or western hemlock and western red cedar (north Idaho, northeast Washington).

Floodplains developed during the previous period were eroded and the river flowed more swiftly down a trough-like gravel channel, which it scoured annually during flood stage. The water table was lowered and habitats for conifer and riparian woodland were greatly reduced. Removal of fine sediments and lowering of the water level had expanded rapids and, possibly, increased their number. With warming, drying conditions, conifer populations along the canyon walls had been reduced and forests on nearby hills were more open. These conditions obtained in historic times, before Chief Joseph Dam slowed the Columbia into Rufus Woods Lake.

CHAPTER XI

SETTLEMENT PATTERNS AND RESOURCE UTILIZATION

Patterns of Settlement and Resource Utilization

We have now presented the building blocks of an anlysis oriented toward the evolutionary paleoecological study of human adaptive strategies in the Study Area and vicinity. These are the identification of occupations, chronological ordering of occupations, functionally-oriented artifact analyses, analysis of resource remains (fauna, flora, lithics) and settlement classification. In this chapter, we combine these data into a chronological sequence of settlement and resource utilization patterns, consider the nature of human adaptive strategies that created those patterns, and speculate whether or not the changes we observe might be a response to vicissitudes of the environment.

Resource Utilization.

Excluding the earth into which pithouses were excavated and the stones used in cooking, we have evidence for utilization of three classes of resource: lithics, fauna and flora. The first two of these categories are well represented, the third is rare in our sites. In both lithics and fauna, we see interesting changes and/or spatial variations. These are discussed below.

Lithic Material Utilization.

Our purpose in this analysis was to ascertain the proportionate exploitation of lithic resources obtained from the vicinity of each site. We have, therefore, chosen to consider only lithic debitage, the byproduct of stone tool manufacture. Looking only at waste material reduced from larger blocks of stone presumably transported from nearby sources, we come closest to measuring the acquisition of stone and its reduction into tools for immediate use. If we included lithic tools in the analysis, we would be counting not only those items made on-site for use on-site but also tools manufactured elsewhere and curated for use in a multiplicity of tasks at various localities. Curated tools, if added to our lithic material counts, would skew our measurement away from local resource use in a more generalized measure of stone resource preference.

There are interesting differences in the proportionate representation of lithic debitage among our dated occupations (Table 11). Differences at first appeared to be correlated with site function and to indicate temporal variation in lithic resource use. Closer inspection indicates that geographic variation in lithic availability is a more probable explanation.

Ogives (cumulative percentage graphs; Figures 24 and 25) illustrate lithic percentages (by count) from Period II and Periods III and IV respectively. Graphs include occupations with 16 or more objects and exclude smaller assemblages and the partially-mixed Occupations 45OK207 I and 45OK208 I.

Note the clear separation between graphs for housepit occupations (45OK207 II, 45OK208 II, and 45OK219 II) and non-housepit occupations (45DO190 III and 45DO394 IV) in Period II. Jasper, chalcedony, and other cryptocrystallines totally outnumber other materials in housepit occupations, but in non-house settings, quartzite takes a more prominent role. Two variables besides site function may be operative here. The first is geography. Housepit occupations are on the Okanogan County (north) bank; other, non-house occupations on the Douglas County (south) bank. Material availability may thus be a factor. Second, the quartzite-rich samples are small and sampling error may have severe impact on our perception of occupation content. However, it seems less than coincidental that both settlements of class S-L, which also contain similar faunal assemblages, should evince similar lithic material contents solely as a result of sampling error. If sampling error were responsible, the occupations would more likely be dissimilar because of random variation, as for example the distinction between 45DO394 I and 45DO394 III, the smallest assemblages in the Period III/IV groups (Figure 25).

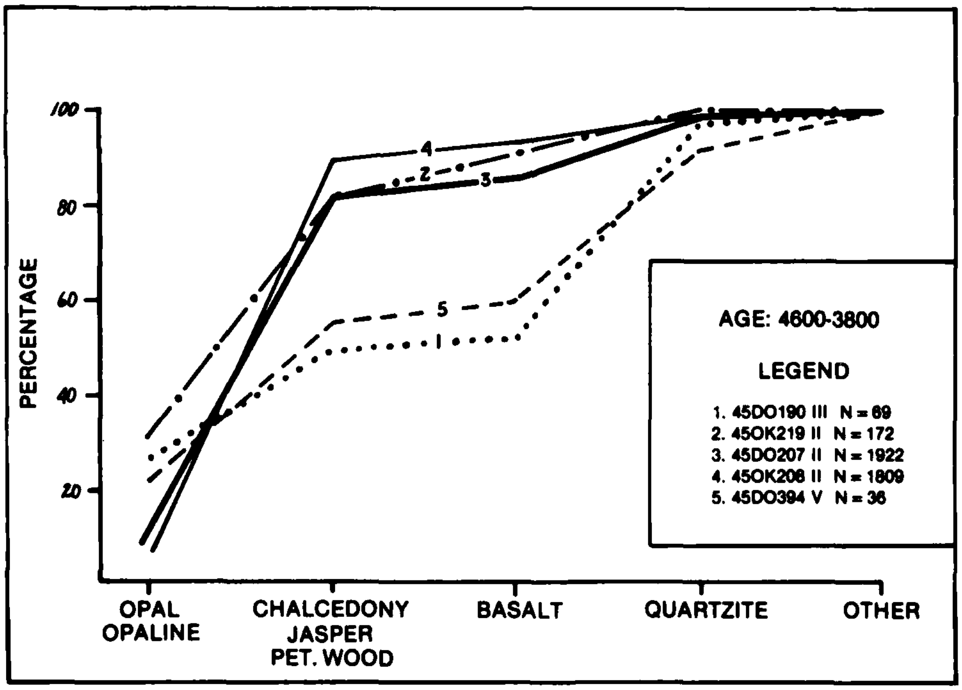


Figure 24. Cumulative percentage graph of lithic utilization at Period II occupations.

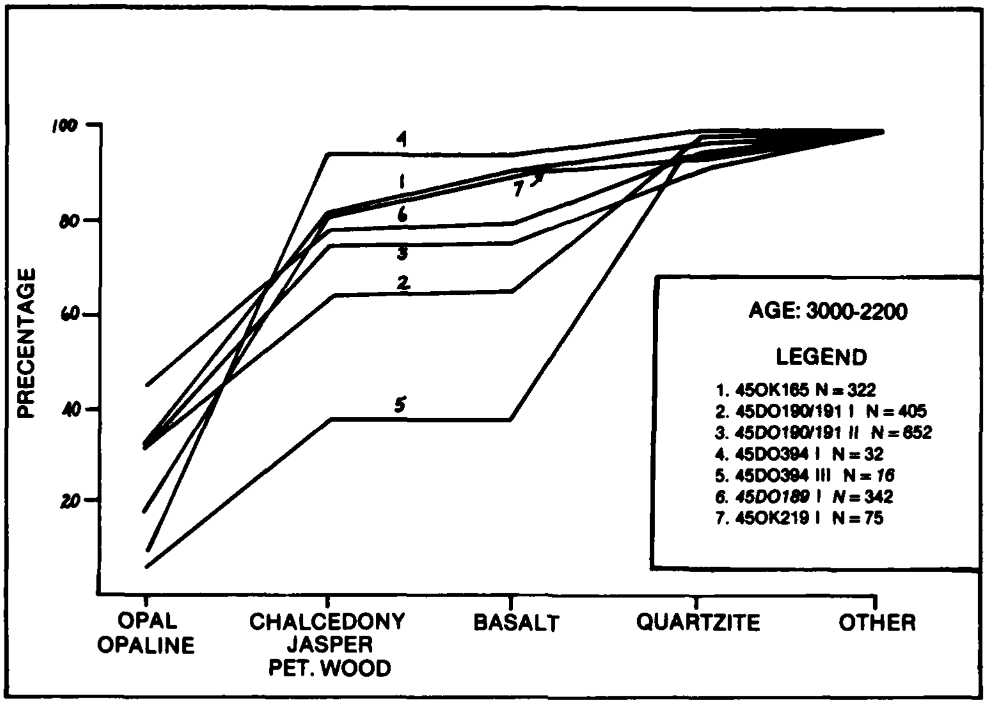


Figure 25. Cumulative percentage graph of lithic utilization at Period III and IV occupations.

Setting aside sampling error as an explanation for lithic material variation among Period II occupations, we can evaluate geographic (material availability) and functional explanations by considering the results of lithic material analysis for Periods II and IV. If geographic variation is the better explanation, we should see higher proportions of Jasper/petrified wood/chalcedony and lower quartzite frequencies on the Columbia's north bank and the inverse on the south bank, independent of settlement class. If site function is the better explanation, a correlation between settlement class and material use should hold independent of geographic position.

Except for the two smallest occupations 45DO394 I and III, in which small sample size appears to have occasional erratic variation in material counts in settlements of the same class (S-N), data support the geographic explanation (Figure 25). Both north bank occupations 45OK165 I and 45OK219 I contain predominantly cryptocrystallines, although they are of distinct settlement classes (HOM and S-N, respectively). The three HOM occupations on the south bank (45DO189, 45DO190/191 I and II) have higher proportions of quartzite.

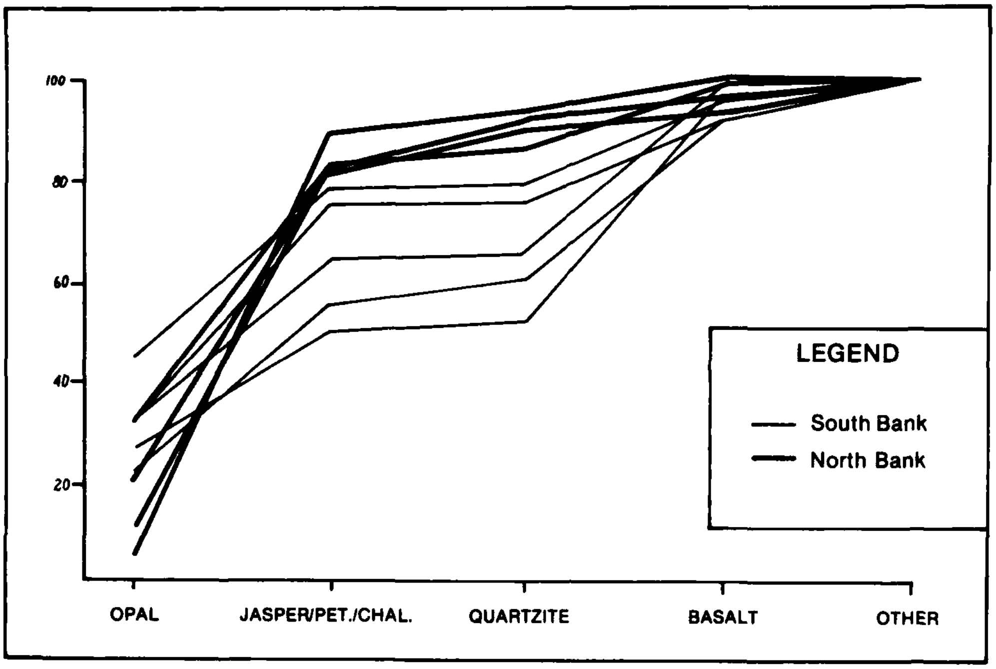


Figure 26. Cumulative percentage graph of lithic utilization material from all occupations with 50 or more items.

When all assemblages from Periods II, III and IV are combined on one graph (Figure 26), with the tiny 45DO394 assemblages excluded, the pattern shows clearly. Not only is quartzite more common on the south bank, but opal comprises a higher percentage there as well. Therefore, the difference in lithic usage seen in occupations from Period II is most likely due, not to differences in site function, but to differences in the availability of stone, probably cryptocrystalline materials, to people on opposite river banks.

Faunal Utilization.

In addition to variations associated with site function, which we used in devising our settlement classification (Chapter IX), there are also temporal and geographic differences among faunal assemblages. In the following paragraphs we describe some of these differences in detail and offer tentative reasons why they occur.

Functional Variation. Assemblages of faunal group M (45DO189 I, 45DO190/191 I, II, 45OK165 I, 45OK297 II, 45OK208 II and 45OK219 II) are always associated with housepit occupations and usually occur with use wear group O. These assemblages include the big four: deer, salmonid

fish, turtle and marmot, with either deer or fish the most frequent (Table 19, Chapter VIII). These species, along with the ubiquitous river mussel, comprised the bulk of the winter protein diet (if we exclude the obvious but uncontrollable possibility that large quantities of boned, dried meat may have been obtained elsewhere and stored in or near housepits for winter). When bison, elk, pronghorn, nonsalmonid fish, hare and dog/coyote occur, it is nearly always in housepit occupations (sampling error may be at work here). Mountain sheep are almost always present, but in very low frequency. Muskrat and porcupine are never present; birds and snakes are rare.

This "winter" food supply probably represents animals gathered in quantity during other seasons and stored (salmon, marmot), those obtained during the winter season, when they were locally abundant (deer, bison), animals opportunistically obtained during winter (mussels, dog/coyote, hare, birds, nonsalmonid fish) and animals whose parts are used for tools (beaver - only the incisors occurred in our sites, one of them ground and utilized; perhaps turtle).

Faunal group L is quite different. Although small and subject to sampling error, assemblages in this group (45DO190/191 III; 45DO394 I; 45OD208 I) nonetheless exhibit differences from group M that cannot be attributed to sampling alone. Salmonids, in fact all fish, are absent: deer or mountain sheep and turtle are always most abundant. The only other taxa present are either porcupine or muskrat. Neither of these rodents occurred in any group M housepit-associated faunal assemblage. This fauna appears to represent the opportunistic killing of game by foragers seeking any form of food available or by collectors, for whom hunting is a secondary subsistence activity. In the ethnographic record, plant gathering and processing and fishing activities were associated with this sort of hunting pattern (Ray 1933). Binford (1980) refers to this as an encounter foraging strategy (cf., Pianka 1978); the hunter takes any animal considered edible.

A pursuit strategy (Pianka 1978), concentrating on ungulates, is indicated by Group N faunas. Again, not associated with housepits, Group N faunas include almost solely the ungulates - deer and mountain sheep. In two cases (45DO394 I and III) mountain sheep is either the only ungulate or the more common ungulate. At 45DO394 II and 45OK219 I, it is deer. The only other economic species in such sites is marmot, and it is rare. Sites of Faunal Group N seem to represent hunting activity. The ephemeral nature of occupations of this type supports the idea that people were infrequent visitors, camping while in pursuit of large mammals.

Site 45OK205 contains an unusual assemblage of vertebrates. Birds and snakes are the most common animals and a diversity of other species - deer, elk, hare, dog/coyote and salmonid fish are present as single elements. This is Faunal Group P, a residual category similar to no other. Opportunistic foraging definitely is indicated here. We at first suspected that snakes and birds were present through natural processes, but 45OK199, 208 and 207 are in nearby identical habitats and none of these contained more than two elements of either taxon. This is in spite of the far higher volume of earth excavated at 45OK207 and 45OK208. The assemblage is likely a cultural one.

Geographic Variation. One taxon, pronghorn, occurs only on the south ~~side of the river~~ in this set of occupations. Livingston (1983) observed the same phenomenon. This is probably due to habitat difference. The north side is mountainous and partially forested; the south of the river is more open, steppe country. Pronghorn prefer the latter (Einarson 1947, Van Wormer 1968). (Note: we have found pronghorn on the river's north bank at 45OK197, dated 1400-1600 BP and it also occurs at 45OK11, 2 and 258 [Livingston 1983]).

Hares (jackrabbits or snowshoe) and dog/coyote occur only in sites on the river's north shore, but there is no likely ecological explanation for this phenomenon. Jackrabbits are animals of the open steppe; dogs are man's symbiotes and coyotes are ubiquitous in arid and semi-arid North America. Because these taxa do not occur in all north bank housepit sites (as do pronghorn on the south) and because the sites in which they are present are all Period I and II age, cultural change is more likely to be what we are seeing here. The presence of pronghorn only in Period III sites may also represent change of either an ecological or cultural kind.

Temporal Variation. Overall, at least in the proportionate representation of various taxa, there is little change between Periods I and IV in people's pattern of exploiting fauna. Deer and salmon are always most important (in winter at least), while marmots, turtles and mussels are common supplements to the diet. There is a distinct change, however that bears on our understanding of prehistoric human adaptation. That change is a gradual reduction in the diversity of taxa used and the relative importance of small versus large animals.

Between Periods I and II, 16 taxa are represented, including birds, snakes, fishes, dog/coyotes, hares, four species of rodents and four kinds of ungulates. Hare, dog/coyote occur in three of the four largest Period I and II faunas and dog is present in the fourth. Rattlesnake and king/bull snake are present in one Period II assemblage. None of these taxa is present in any Period III or IV occupation.

Only 11 of the 16 taxa remain in Period III, eight in Period IV. Pronghorn raise the Period III count to 12, but their occurrence is geographically correlated and probably does not bespeak a change in foraging strategy.

Thus we see the diversity of faunas decline from 16 to 12 to 8 over a 2300 year period. The small number of taxa in Period IV may be partly the result of small samples, but the Period II-III change is probably real. It will be interesting to test this observation with faunal data from sites excavated by the Chief Joseph Dam Cultural Resources Project.

We can add another observation, a corollary to the reduction in taxonomic diversity: of the 12 remaining taxa in Period III, five are ungulates; deer, mountain sheep are the primary species with pronghorn, elk and bison occurring to a lesser degree. Not only do people seem to be exploiting fewer kinds of animals in Periods III and IV, but they are also focusing their efforts increasingly on large mammals.

Our small sample indicates that during Periods I and II people were engaged in more of a broad-spectrum pattern of foraging than were their successors. This is most apparent in 45OK205 I, a Period I occupation, wherein birds and snakes predominate. By Period III the people had begun to focus on fish, ungulates, and a narrow range of other smaller animals. In this regard, it is interesting to note that two of the three Faunal Group L assemblages and none of those assignable to Group N occur in Period II. Hunting in the riverine environment may be shifting from an opportunistic encounter strategy to a narrowly-based pursuit strategy focusing on marmots and ungulates.

Settlement Patterns

Settlement Classes: Interpretation

Each occupation containing at least features and faunal remains was assigned to a settlement class (Chapter IX). These various settlement classes can be tentatively interpreted as representing specific constellations of activities as follows:

HOM and HAM settlements. With their housepits, diverse tool assemblages and deer/salmonid/turtle faunas, these are clearly base camps (or residential bases - Binford 1978, 1980). They were probably inhabited during at least the winter months, as occupations 45DO190/191 I and II indicate. While the presence of salmon and marmot (and perhaps turtle) seem to contradict this statement, there is ample ethnographic evidence that summer-and fall-run salmon and spring-and summer-active marmots were dried and smoked for storage (Ray 1933; Elliott 1914). Since this was common practice historically, we cannot assume the presence of salmon and marmot indicate non-winter seasons of site occupancy. HOM and HAM occupations seem to have been permanent (on the order of a decade, more or less) winter residential bases where a diversity of tool-using activities was performed and both stored and winter collected foods were consumed. We combine these classes for the remaining analyses.

S-L, TUL settlements. Members of both classes appear to represent short-term food gathering and/or processing camps (Binford's field camps). Faunas are diverse and in all cases include at least one species (e.g., porcupine, muskrat) that was not found in any HOM or HAM occupation. Animal procurement from both sites seems to have been opportunistic, following an encounter strategy (if it moves, eat it). Occupation 45OK208 I, the sole member of class TUL, contained very discretely patterned distributions of shell and fire-broken rock around an earth oven feature, leading us to suggest that site activities were systematically performed by a task group oriented toward processing of some food, possibly vegetable in nature. We observed no such tendency for patterning in either S-L occupation, although we did not expose a large block area at either site (see Appendix A, reports on 45OK208, 45DO190/191 and 45DO394). Settlement patterns also give us good reason to suggest that activities performed at S-L and TUL occupations were quite different from each other in their orientation (see Environmental Distributions, below). The tool inventory of the one S-L class settlement with more than four tools was diverse, indicating a range of activities.

Occupations of class S-L appear to be short term field or base camps used by people with an encounter resource collection strategy. By contrast, TUL seems to represent the field camp of a task group organized to gather and process specific non-faunal resources. Animal procurement at this kind of settlement was secondary and, therefore, opportunistic.

S-N settlements. These are occupations in which midden and hearth features occur with a restricted fauna comprised of mountain sheep and/or deer and, occasionally, marmot. If we assume that marmots were hunted from the sites wherein they occur, then at least some of these occupations represent non-winter habitation. With limited tool inventories (light scraping tools, hammerstones and projectile points characterize the only "large" assemblage from this site) that seem oriented toward hunting and processing of game, these occupations seem to represent field camps of groups whose specific task is the killing and processing of deer and mountain sheep.

SAP settlement. We found only one settlement of this class, 45OK205 I. Occupation 45OK219 III has a similar tool inventory, but without either features or fauna, it cannot even be tentatively assigned to this class.

The SAP settlement class is unique in its faunal assemblage. There are four mammal, three reptile, salmonid fish and bird represented in what snake remains (and probably also salmon) indicate to be a non-winter occupation. In spite of this faunal diversity, there is a tool inventory, with nearly 70% of them class 3. Apparently we are looking at either a field camp or residential base used by people with a foraging adaptation (Binford 1978, 1980) who used a limited set of tools in the exploitation and consumption of opportunistically-collected food

resources.

Settlement Patterns and Change.

For each time period represented among our sites we considered the environmental distributions of the various settlement classes, HOM, HAM, S-L, SAP, TUL and S-N (Table 24). In observing the relationship between settlement classes and environmental variables we hope to discern as precisely as possible those factors that were most important to settlement location. Proximity to critical resources (food, water, minerals), shelter from or exposure to wind and solar energy, and protection from or access to other human populations are the major classes of variables that we expect to condition settlement locations. By determining correlations between variables in these classes and classes of settlements, we obtain increased understanding of the interaction between people and their environments,and the nature of their adaptation to that environment. By noting changes in the environmental distribution of settlements and tying these changes to shifts in patterns of resource utilization we develop an image of evolution in local strategies for adaptation.

The environmental variations available for our analysis are, unfortunately, few. We know little about modern distributions of biotic resources including the distribution of fish or shellfish in the pre-dam Columbia River, patterns of game movement along the river bottom and the distribution and diversity of upland plant and animal resources in the river breaks. Even if we possessed adequate data on the modern biota, we cannot state with an acceptable degree of certainty whether or not even late-prehistoric floral and faunal distributions were the same as they were in historic times. Considering variations in the riverine environment, especially its hydrologic regime, and the overall availability of moisture for plant growth, there have certainly been marked changes in local ecosystems during the past 6000 years. We cannot control for these changes with the precision needed to arrive at for an analysis of variables influencing settlement patterns.

Table 24. Temporal Distribution of Settlement Classes.

Period	Unknown/ Unassigned	HOM	HAM	TUL	SIN/S-N	SOL	SAP	TOTAL
IV		1		1	1			3
III	2	3			3			8
II		2	1			2		5
I	1						1	2

Therefore, we have focused our analysis on three variables that we are able to measure with accuracy and either affect or may have affected peoples access to critical resources. Two of these are directly tied to physical resources: the exposure of a site to winter sun and a site's proximity to non-riverine sources of water. A third-variable, topographic position relative to river level, indirectly measures proximity to riverine resources - the riparian flora and fauna plus fish, shellfish and aquatic mammals - and protection from floods.

Alternatives within each variable are: Access to modern nonriverine water - perennial stream, active intermittent stream carrying annual runoff, no stream or an inactive intermittent stream; exposure to winter sun - full partial, none; and Terrace Level - high terrace (T2 or T3), lower bar T1, upper bar T1. Results of this analysis are described below and illustrated in Figures 27, 28 and 29.

Nonriverine Water. It is interesting that so few occupations, even semi-permanent winter residential bases are now adjacent to perennial sources of water (Figure 27). Two (45OK205 and 45DO189) haven't even an annually-filled, intermittent stream within 100m. Either 1) nonriverine water was not important at all or not important during the season(s) of occupation, or 2) the now-intermittent streams were flowing year-round in the past. Considering the environmental changes that occurred in the period represented by all of these sites (>5000 BP to 1600 BP, Chapter X), the first alternative explanation is the more likely one. The area's inhabitants probably relied on the Columbia River for most of their water.

Winter Sun. Winter sun exposure appears to have been an important consideration in the location of HOM and HAM sites, all of which have either full or partial (45DO189) exposure to winter sun (Figure 28). Non-house settlement classes S-L and S-N have no such requirement, occurring at 45DO394, which the winter sun does not reach. Therefore these settlement classes may not have been used in winter, as faunal remains also suggest for some S-N occupations.

That all Period I sites occur in areas of good solar exposure is best attributed to sampling error. We excavated at no winter sunless sites in geologic settings old enough for Period I. We have no ready explanation for the lack of Period IV sites in winter-sunless settings, except that, unless sampling error is involved here, too, all sites may indeed represent only winter habitation (or supposed winter habitations were actually utilized year-round).

Topography. Topographic distributions of settlement classes (Figure 29) indicate human responses to the erosional effects from environmental change. Both Period I occupations (45OK205 I and 219 III) are on high terraces. Period II winter residential bases (45OK208 II, 45OK219 II and 45OK207 II) are on high terraces, while both short-term field camps (45DO190/191 III and 45DO394 V) occur in low-bar riverbank settings. By Period III, most winter residential bases and nonwinter hunting camps are on the upper bars of the aggrading T1; utilization of high terraces, although continuing, is much reduced in proportion to earlier periods. Finally, in Period IV the T1 setting is abandoned for high ground again. In part, this pattern of change is related to climatic events, or at least changes in the Columbia's hydrology (Chapter X). In Period I, before 4700 BP, the Columbia River was not aggrading (or at least the floodplain formed by any minor aggradation during that period has been obliterated). The river appears to have had low flows in an infrequently flood-scoured gravel bed. Subsequently, around the onset of Period II (4500-4700 BP), the Columbia's level rose and the river began to aggrade a floodplain. In the early stages of aggradation, river waters would have scoured away most fine grained older sediments, many of which must have contained archaeological sites. The Period I occupations we found at RM590 may be merely the erosion-spared remnants of a once more abundant and more widely distributed site-population.

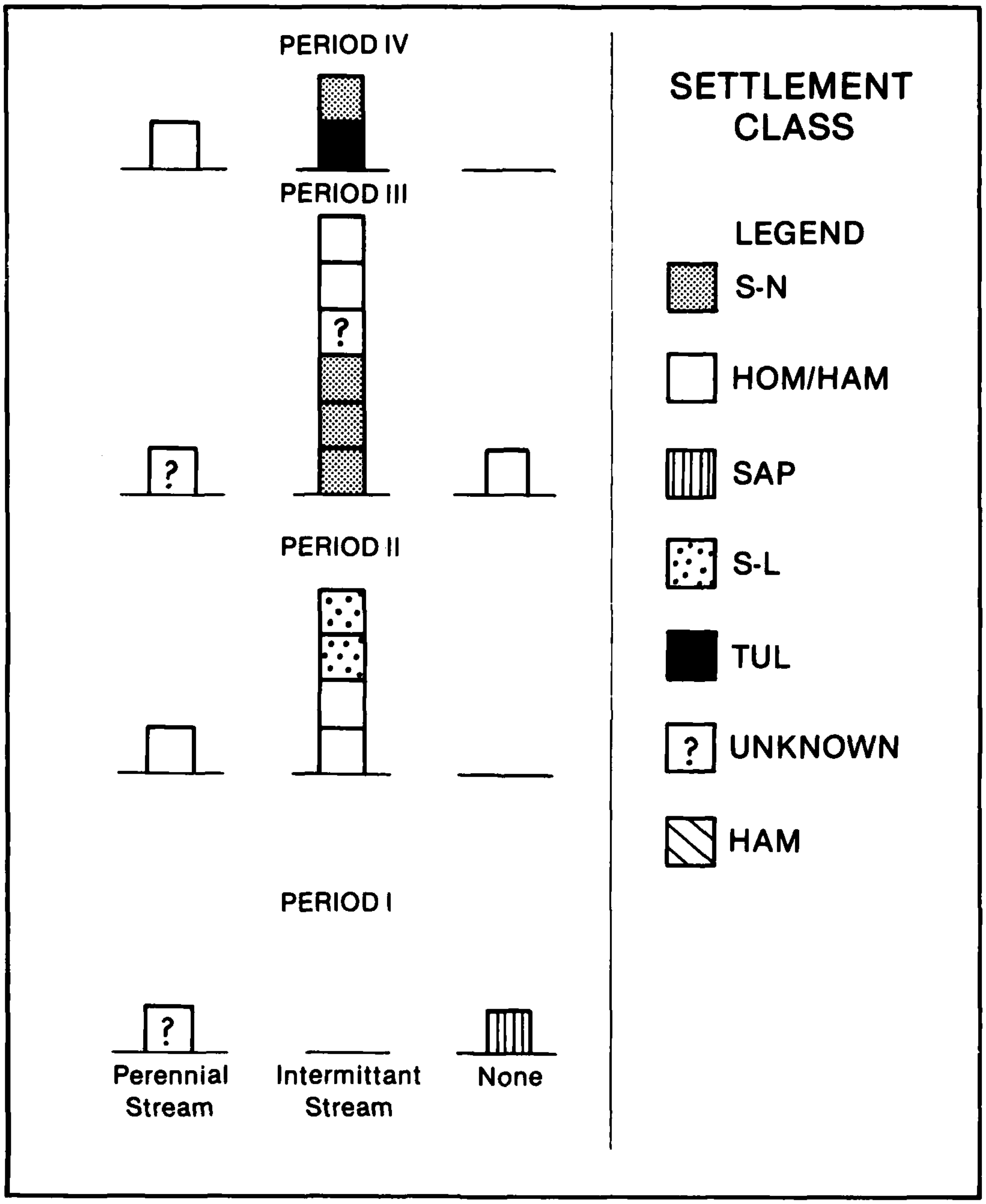


Figure 27. Distribution of settlement classes with respect to non-riverine water for Periods I through IV.

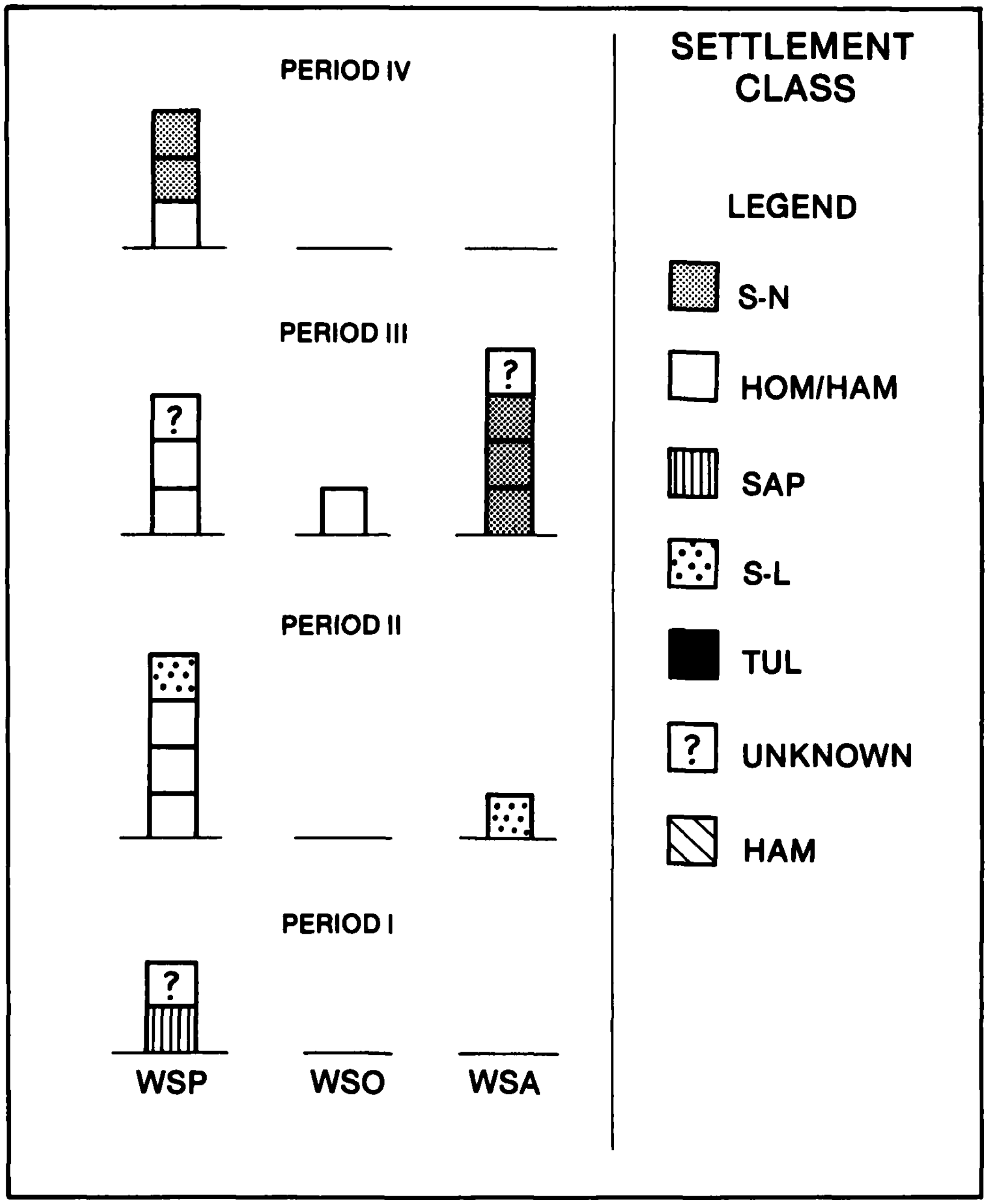


Figure 28. Distribution of settlement classes with respect to winter sun exposure for Periods I through IV. WSP = Winter Sun Present, WSO = Partial Winter Sun, WSA = Winter Sun Lacking.

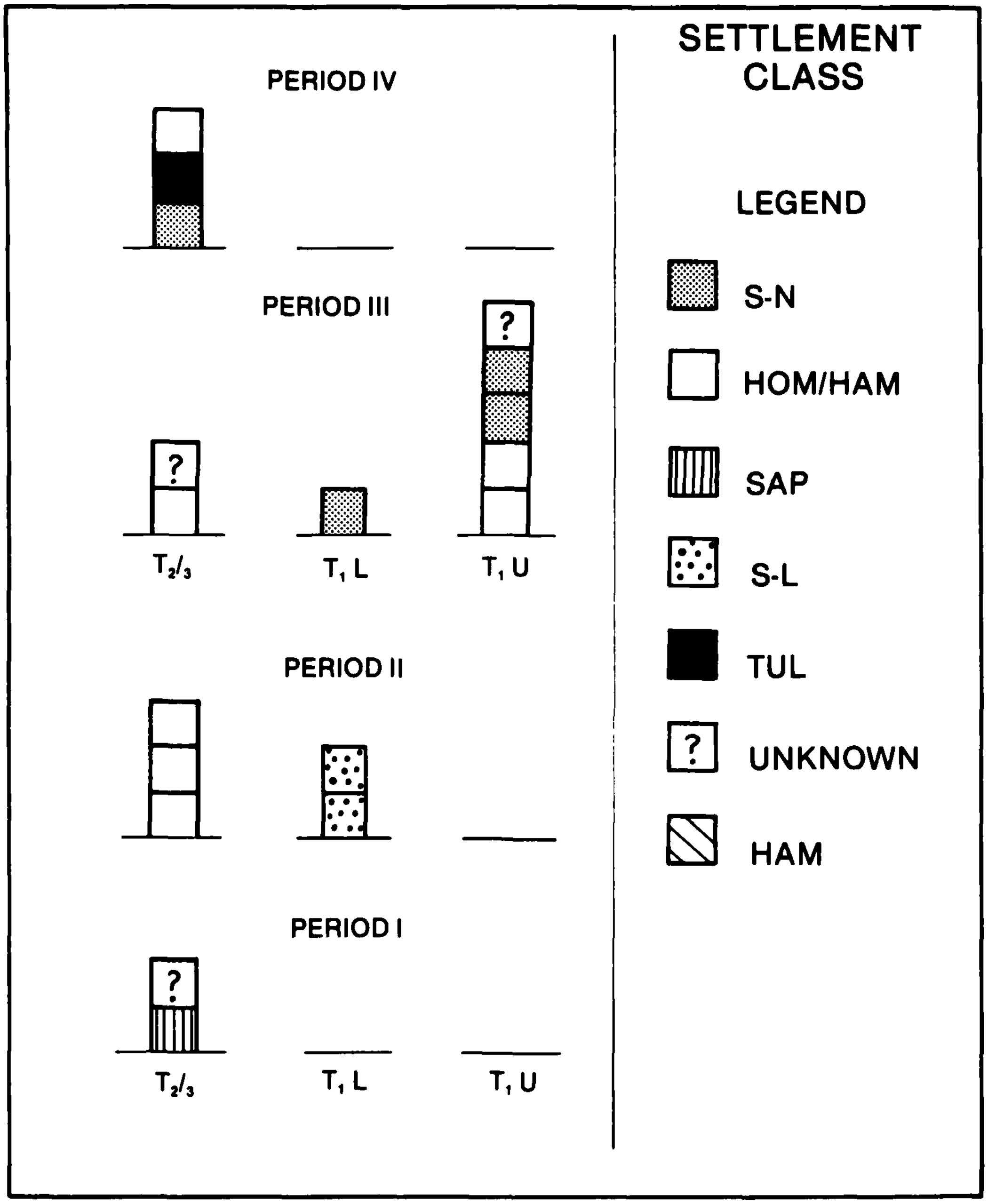


Figure 29. Distributions of settlement classes with respect to terrace level.

When the river rose, and removed lower bars, the newly-forming floodplain was still too low and frequently flooded to make the construction of permanent (i.e., multi-annual) dwellings feasible, people seem to have shifted their winter base camps to the higher T2 and T3 terraces. Minor resource collection activity took place on lower bars between flood seasons.

After the floodplains were built sufficiently high that only the major floods reached upper-bar levels, people again moved to lower elevations. Then, shortly after 2500 BP, either the low-elevation settings became uninhabitable and people took refuge on high ground, or erosion has destroyed all sites that were present near the river's edge. Both explanations are possible. Warming temperatures coincided with reduced precipitation between 2400 and 2600 years ago. This was the end of the Temple Lake Stade of Rocky Mountain Glaciation (Richmond 1965), and rivers flowing from glaciated mountains would seasonally contain large volumes of outwash from melting ice. At the same time, due to drying, non-glaciated rivers should have had a reduced flow at all seasons, leading to reduced hydraulic damming effects, perhaps lower water levels overall, and low non-runoff season levels in the Columbia. With this change came massive degradation of the T1 floodplain (Chapter X) and, again, it may not have been feasible between 2500 and 1600 BP to construct pithouses near the river. An alternative explanation might be that lower elevation occupations of this age had been eroded away during that period of floodplain degradation. High ground Period IV occupations may either be the only ones deposited or the only ones that remain in the RM590 vicinity.

Changes in Patterns of Pithouse Habitation.

We recorded 10 housepits (or probable housepits) in seven occupations. In only 45OK207 II did we observe more than one housepit (there were four) and only at that site was there a possibility that more than one housepit (No.'s 1 and 3) could have been occupied simultaneously. It was in the apparent duration of housepit habitation that we observed some temporal variation.

Our numbers are small, especially so when we attempt to address the question of change. Statements we make here about changing patterns of pithouse habitation are hypotheses we have induced from our data base. They must, of course be tested with a larger body of additional data.

House floors. Housepits at 45DO189 I, 45DO190/191 I and II, 45OK219 II, 45OK208 and three of four housepits at 45OK207 contain but one floor deposit each. We conclude that the occupancy of these sites was therefore brief and continuous over a sequence of at least winter seasons.

Housepit 1 at 45OK207 II and the single recorded housepit at 45OK165 I indicate either more than one occupation event (207 II) or nearly continuous occupation in the same pit. In the case of 45OK207 II, Housepit 1, we are uncertain whether or not, because it is so shallow, the second (upper) occupation actually represents pithouse use (see Appendix A, 45OK207, Housepit 1). If indeed this upper occupation layer is a pithouse floor, then reoccupation occurred long after the original pithouse had been abandoned and over 50cm of fill had accumulated.

Occupation 45OK165 I is a different case entirely. The housepit depression we found at this site contains nearly 80cm of black, artifact-rich fill, in which at least three distinct lenses of fire-broken rock can be distinguished. Use of this pit as a dwelling appears to have been long term; it seems the site was re-used as a residential base for at least several decades. similar phenomenon was observed by Lyman (1976) at the Period V house at 45OK5.

Change in Habitation Pattern. It appears that in Periods II and III single houses were occupied for short periods, then abandoned. If people returned later to the same spot, either they excavated a new pit or reused an old one, but only after considerable back filling had taken place. Both these phenomena occur in 45OK207 II.

During Period IV, however, this habitation pattern may have been changing to long-term re-use of single or perhaps, multiple dwellings. This change may partially explain the apparent paucity of Period IV occupations in our Study Area.

Summary: Adaptive Strategies

We now use data and interpretations presented in the foregoing sections to characterize the adaptive strategies of people inhabiting the RM590 Study Area during various periods in prehistory. To do so we have employed the concepts developed by Binford (1978, 1980) for understanding the relationship between hunter-gatherer adaptations and their material residue. The following descriptions of strategies are summarized from Binford (1980): the discussion of site contents is largely our own.

Binford views hunter-gatherer adaptive strategies as nodes on a continuum between foragers and collectors. Foragers are people who move their residences frequently to gather seasonally available foods on an opportunistic basis; they rarely mass-produce foodstuffs for storage. Archaeologically, foraging adaptations produce two kinds of sites: residential bases (or base camps) and locations (more of dispersed scatters of tools and detritus left in resource collections areas); resource collection technologies are generalized (devised for a multiplicity of plants or animals) so tool inventories should be low in diversity. There may not be great diversity among tool inventories at various, seasonally inhabited residential bases, but due to the opportunistic, encounter strategy of resource procurement, floral and faunal remains should be quite diverse. Features in such sites also should be generalized, including dwellings, food-preparation facilities such as hearths, and trash middens.

Collectors, in contrast, make either no residential moves, or at most a few moves to better position themselves to a constellation of seasonally abundant resources. Food gathering is systematic and focuses on only a portion of the number of available species. Using a pursuit strategy, task groups frequently leave the residential base and set up field camps, from which specific resources are gathered and processed for storage at either nearby caches or a permanent, residential base. This is called a logistic adaptive strategy. Technologies are complex and specialized (e.g., the Puget Sound area: Smith, 1940; Haeberlin and Gunther, 1930).

The archaeological residue of collectors includes five kinds of sites:

residential bases, locations, field camps, caches and lookouts (Binford 1978, 1980). Residential bases, as staging areas for an assortment of complex technologies, should have diverse tool assemblages along with dwelling, cooking and trash features. Faunal and floral remains also should be diverse, and, because of storage, might represent times of year other than the season of habitation. Field camps, on the other hand, should show low intra-site diversity in both tool inventories and floral/faunal remains, but high inter-site diversity due to the distinct tasks performed in them. Features should be predominantly oriented to cooking and mass processing of foodstuffs or other resources (e.g., stone). Caches are selfexplanatory; locations are similar to those of the foraging adaptation. We have no comment on lookouts.

By comparing the probable material residues of collector and forager adaptations with the archaeological record, we have arrived at very preliminary notions about human adaptive strategies in the RM590 area. These are, by time period, as follows:

Period I, >4700 BP.

We found only two occupations representing this period, 45OK205 I and 45OK219 III, both situated on high, erosional terraces (T2 and T3 respectively). Only from 45OK205 I did we recover enough data to identify settlement class. Therefore, we had insufficient data for constructing settlement patterns. However, we can comment on the nature of seasonal adaptation indicated by 45OK205 I. With its low-diversity tool inventory and highly diverse faunal inventory, 45OK205 I appears to have been a non-winter residential base to which resources were gathered opportunistically using a generalized technology. This indicates an adaptation closer to the foraging end of the hunter-gatherer spectrum.

Period II, 4700 to 3500 BP.

Five RM590 occupations date to this period. 45DO190/191 III, 45DO394 V, 45OK207 II, 45OK208 II and 45OK219 II. All but one are over 4000 years old. Three occupations (45OK207 II, 45OK208 II and 45OK219 II) are winter season residential bases on high, erosional terraces. The two other occupations represent either short-term residential bases or field camps low on river bars. Both kinds of settlement contain diverse faunas and tool assemblages, leading us to suspect that both represent seasonal residential bases.

The faunal assemblages in winter bases indicate opportunistic resource collection from the base camp along with selective hunting of deer and the harvesting and storage of salmonid fishes. The existence of storage is confirmed by the deep pit found in Housepit 3 at 45OK297 II. Food gathering from occupations on low-river bars was opportunistic, suggesting that these represent short-term residential bases rather than task-oriented field camps.

Pithouses in winter bases first were shallow and ovate, then waist deep and round to square. Each appears to have been occupied for a short period of years, then abandoned; no housepit was used repeatedly over a short period of decades. Usually, only one house was in use at a site at any one time.

These data indicate an adaptive strategy somewhere between Binford's foragers and collectors. There is evidence for broad-spectrum opportunistic collection of animal resources, but at the same time we see selective focusing on deer and salmonid fish. Storage is evident both in the presence of salmon bone in housepits(1.) and the storage pit found in Housepit 3 at 45OK207 II. People were constructing residences requiring substantial labor investment, but only lived in each for a short period of time, relocating winter bases every few years. The adaptive strategy might be called central based foraging/collecting. People set up a winter base, foraged the area clean of resources after a few years, then moved elsewhere for another sequence of winters. At the same time, they are harvested salmonids for storage, possibly using a collector-type procurement strategy, possibly also operating from the "winter" central base.

Period III 3500-2500 BP.

Eight of our occupations date to this period (45DO189 I, 45DO190/191 I and II, 45DO394 I to IV, 45OK219 I). Two kinds of settlement are again present: winter residential bases situated in upper river bar (45DO190/191 I and II) and high terrace (45DO189-I) settings, in areas

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(1.) Note: An alternative explanation for the presence of salmonid bone in pithouse floors is the utilization of base camps year-around, including during salmon runs.

with winter sun exposure and non-winter field camps situated in various settings that winter sun may or may not reach.

The field camps contain limited tool inventories and faunal assemblages containing almost exclusively mountain sheep and/or deer. They apparently represent task groups focused on large mammal hunting using a pursuit strategy. As in Period II, winter residential bases contain single, briefly occupied houses. Storage is evident in the presence of marmot and salmonid fishes in these winter bases. Faunas utilized in winter bases are less diverse than in Period IV, and show an increased focus on ungulates. Apparently, food gathering from winter camps was less opportunistic than it had been previously; people may also have been able to rely more heavily on stored foods.

Period III adaptive strategies still appear to have been a form of central-based foraging/collecting, but with increasing emphasis on provisioning of specific foodstuffs - collector end of the spectrum.

Period IV.

We have only three occupations attributable to this period: 45OK165 I, a winter residential base; 45OK207 I, a field camp focused on large mammal hunting and meat processing; and 45OK208 II, a task-oriented field camp at which hunting (opportunistic in form) was probably not the primary activity.

The single house we uncovered at 45OK165 had been occupied continuously over many winter seasons. Food gathering during this period shows a sharp increase in focalization, with salmonid fish and large ungulates the principal species being exploited.

The adaptive strategy indicated by this small sample of occupations is again a central-based form, but is very close to Binford's collector strategy. Winter bases are not being moved as frequently as in the previous periods, perhaps due to decreased reliance on local resources and increased use of stored provisions for winter subsistence.

Summary.

What we see indicated at RM590 is change from a possible foraging adaptive strategy in Period I through increasingly focused central-based foraging/collecting in which winter residences are frequently relocated, to a central-based collector strategy in which task groups exploit seasonally abundant resources to provide food for a rarely-relocated winter encampment.

CHAPTER XII

A REVISED OUTLINE OF COLUMBIA PLATEAU PREHISTORY

In the paragraphs that follow we present an annotated outline of human prehistory in the Columbia Plateau, emphasizing adaptive responses to the environmental changes noted in chapter X. Eventually we narrow our focus to the Columbia River and surrounding uplands, from Priest Rapids to Grand Coulee Dam. Information has been drawn from all available documents on regional archaeology with special attention to findings at RM 590 and other sites within the Chief Joseph Project Area. In our presentation, we summarize existing knowledge, including RM 590 findings, then point out gaps in that knowledge by framing a series of research problems. We discuss plateau prehistory as a sequence of time-periods which are bounded by environmental, stylistic and changes in human adaptive strategies.

Earliest Inhabitants: 11,000-8000 BP.

The first people to enter what is now eastern Washington found a cold, barren landscape (Chapter X). Toward the end of this period, however, the climate began to warm and grasslands and forests developed.

For the entire 3,000 years of this period, only a handful of archaeological sites are known; of these, only four have provided data useful to subsistence studies. These are Marmes Rockshelter on the lower Snake (Fryxell and Daugherty 1963; Rice 1969), Lind Coulee near Moses Lake (Irwin and Moody 1978), Five Mile Rapids (Cressman 1960) at The Dalles and Kettle Falls (Chance and Chance 1977; 1979; 1983) on the upper Columbia. Sites dating to this period have been found in the central Columbia Basin and on the Lower Snake and Clearwater Rivers (e.g., Leonhardy 1970; Ames et al., Toups 1969) and others may exist in the Horse Heaven Hills south of Yakima (David Rice, personal communication). Only two sites representing the period occur near the Study Area: the Rock Island Overlook above Rock Island Dam (Valley 1975), and a site recently discovered behind Rocky Reach Dam (Meirendorf 1983). Neither of these nearby sites contains the plant and/or animal remains so important to understanding subsistence patterns.

Based on the little information we do possess, this period, called variously the Pioneer Period (Daugherty 1962) or, on the Snake River, the Windust Phase (Leonhardy and Rice 1970; Rice 1972), was characterized by scattered, small bands of people living by what Schalk and Cleveland (1983) have called "broad spectrum foraging". They seem to have followed a seasonal round pattern of settlement, in which the base camp was moved frequently to take advantage of animal foods and ripening plants as they became available at different localities during the various seasons. They seem to have lacked (or not needed) a technology for mass storage of foodstuffs. Plant and animal remains from Marmes Rockshelter represent a winter occupation (deer, mussels, and chubs [Gustafson 1972; Rice 1972]). At Five Mile Rapids summer is represented (salmon and carrion eating birds [Cressman 1960]) and at

Lind Coulee, it is spring (water fowl, eggs, bison with calves [Irwin and Moody 1978]). River valleys, the now-semi-arid central Columbia Basin, and adjacent highlands were all at least seasonally inhabited.

Research Problems: Although we believe peoples of this early period followed a seasonal round, we have yet to obtain enough information from any one area to develop an image of subsistence and settlement patterns and, therefore, adaptive strategies for a regional population. Neither do we know anything about the dwellings (other than caves) utilized by these people. No RM 590 site dates to this early period.

Adaptation to Aridity: 8000-4700 BP.

With increasing dryness, the standing biomass (amount of living matter - plants and animals) of our region certainly declined. The arid central Columbia Basin became nearly devoid of water, and food resources would have been scarce. People restricted their activities to the remaining moist productive environments (the rivers and the brushy riparian vegetation zone that extended along them; Chatters 1980, 1982b), and to higher elevations in the Basin's mountain fringe where enough precipitation fell to support the animal and plant species on which they depended for food (Ames n.d.).

Known variously as the Okanogan (Wells area [Grabert 1968]), Kartar (Chief Joseph [Jaehnig 1983]), Vantage (Priest Rapids/Wanapum [Swanson 1962; Nelson 1969]) and Cascade (lower Snake River [Leonhardy and Rice 1970; cf. Bense 1972]) Phase, this period is in some ways better known and in others more poorly known than its predecessor. Sites representing this period (we will use the term Cascade Phase) are common on the Snake River (Bense 1972; Sprague and Combes 1966; Nelson and Rice 1969; Leonhardy 1970) and its Idaho tributaries (Butler 1962; Keeler 1973; cf. Ames n.d.) and a scattering of sites has been reported for the Columbia (Chatters 1979; Munsell 1968; McCoy 1967; Grabert 1968). Animal remains usually are sparse and in poor condition. Along the Columbia, between the Tri Cities and the Canadian border, only one site (Vernita; David Rice, personal communication) with good faunal remains has been excavated. Those remains have not yet been analyzed.

Schalk and Cleveland (1983) suggest that Cascade Phase people also lived by broad-spectrum, seasonal foraging; data from 45OK205 I seem to support that contention. Large mammals (deer, elk, pronghorn, sheep [Gustafson 1972]) were exploited with large atlatl thrown darts, usually tipped by leaf-shaped, often serrated stone points. A variety of small animals, including hare, dog/coyote, bobcat, turtle, snakes, birds, salmonid fishes and marmot (Leonhardy 1970; this volume) were exploited through what appears to have been an opportunistic encounter-type food gathering strategy. Metates (stone slabs for grinding plant foods or pulverizing dried meat or fish), hand-size grinding stones, and edge-ground cobbles have been interpreted by some as representing the gathering and consumption of seeds, especially grasses (Bense 1972; Browman and Munsell 1969; Leonhardy and Rice 1970). However, we have no direct evidence for this in the form of the carbonized seeds themselves. River mussels are common in sites of this age (Leonhardy 1970; Leonhardy and Rice 1970), and fish bone has occurred (Ash Cave for example, Butler 1961, 1962), but whether either of these resources formed a significant portion of the diet is still unknown. Leonhardy (1970) reports a diversity of mammals from the Granite Point Site, including deer, bobcat, etc., but has presented no frequency data. Faunal evidence from 45OK205 indicates a similarly diverse fauna from a summer season habitation. No remains of dwellings have yet been reported.

Research Problems: We have studied enough collections of stone tools from this period and found enough sites that every Cascade Phase find is not necessarily important. However, we still know very little about the subsistence system of these people, their settlement patterns

(beyond confinement to rivers and highlands), or their dwellings. Any site that can provide more insight into any of these matters would certainly expand our knowledge of this period.

Of more regional interest is the impact of the Mazama ashfall on subsistence. Various archaeologists have suggested that volcanic ash may have further damaged an already fragile environment, reducing densities of some food species below feasible limits for exploitation. Volcanic ash may have injured spawning salmon or destroyed gravel spawning beds in rivers, thereby greatly reducing the anadramous fish resources of the region (Brauner 1975). Others suspect that its effects were minor and short-lived. Any site or sites that span the period just prior to and just following the ashfall (and that also contain well-preserved faunal and/or floral remains) would help answer these questions.

The question of storage and its importance to the development of permanent dwellings, together with changes in population mobility and cultural complexity (Shalk 1977), also should be explored.

Populations Rise and Permanent Houses Appear: 4700-2500 BP.

Arid conditions came to an end throughout Eastern Washington sometime between 4700 and 4000 years BP. Scattered groves of trees coalesced for the first time since the glacial recession, forming the open Pine and Douglas Fir forests of Okanogan Highlands and the northeastern fringes of the Columbia Basin. Sagebrush steppes were invaded again by grasses in the northern and eastern parts of the Basin, and vegetation in the central Basin became more like that we see today. After about 3500 BP conditions also became cooler and small glaciers formed in the high mountains.

Wetter, then cooler/wetter climates brought rising river levels on the Snake, Columbia and probably many of their tributaries. Floodplains again formed and river velocities probably slowed. We have suggested that floodplain building and raised river levels would have resulted in an expanded zone of riparian vegetation and drowned or covered many small rapids along the major rivers.

With more water came a greater standing biomass (there were not only trees, but more forage for mammals, more streams for fish, and a greater density of plants in the steppes). Quite possibly the environment, especially along the rivers, was more productive than it has been in historic times.

If numbers of occupations at archaeological sites are any indication of numbers of people, human populations rose sharply after 4500 BP. In a recent study of radiocarbon dated occuptions, Salo (1983) noted increases in the numbers of occupations throughout the middle and upper Columbia during this interval. People began to spend winters in pithouses, 8-12m in diameter (25-38 ft.), built in areas optimally exposed to winter sun (Lohse 1983a). Pithouses usually occur singly, and commonly occur on terraces well above modern river levels (this is especially true of houses constructed between 4600 and 4000 years BP in the Study Area and vicinity). Along the middle Columbia, houses often occur in small canyons tributary to the Columbia River as well as on the river's main stem (Swanson 1962; Greengo 1982; Hartmann et al. 1982). Most houses appear to have been used only for one continuous period of occupancy, after which they were abandoned (although there are exceptions to this general pattern; e.g., Lohse 1983a). This evidence indicates frequent relocation of the winter base camp, and a pattern of winter settlement in which households were dispersed along the river rather than aggregated into villages (as occurred later).

Other sites representing this period, also found on or very near the Columbia River in side canyons near the river (especially betwen the Wenatchee and Snake Rivers), are secondary residential base camps,

hunting encampments (45DO394), and what appear to have been plant processing stations (site 45DO204 appears to be a root processing site from late in this period; Lohse 1983c) Such sites are common in canyons along the mid-Columbia (e.g., Hartmann 1983). Few definite fishing sites have been found (the only one in the Chief Joseph Project identified with salmon fishing was 45DO214; Miss 1983), although salmon bone and, occasionally bone of chubs and/or suckers is found in housepit sites (Lohse 1983a). Other common prey species were whitetail and blacktail deer, mussels, turtles and marmots (Livingston 1983). Other animals were used but in much lower frequency. Storage in caves, such as Cedar Cave near Vantage (Swanson 1962), or in pits dug into house floors at winter camps (e.g., 45OK207) had been developed by the early part of this period. The presence of salmon in what are probably winter habitations indicates either that the fish had been stored or that the sites were used in summer as well as winter.

Not until the end of this period (no earlier than around 2700 BP), did people begin to re-inhabit the open, upland environments of the Columbia Basin and montane foothills (Chatters 1981; see Osborne 1967; Sprague 1959). Food, stone for tools, and all other resources seem to have been derived from a strip of land extending no more than 10 miles from the main rivers. Thus, even though the environment of the region had improved, people's heavy reliance on (or ability to focus their food acquisition activities along) the river continued from the Cascade Phase. Therefore it appears that either people had not developed the ability to use resources in the Columbia Basin and uplands, or that they had no reason to extend themselves far from the river.

Several factors thus lead us to suggest an adaptation different from that observed in the area historically. These factors include: the settlement pattern of single, briefly occupied pithouses scattered along river floodplains, upper terraces, and side canyons; the presence of nonresidential sites for opportunistic and, later, task specific hunting and plant processing; the paucity of fishing-oriented encampments; the predominant use of stone available near the river (Chatters 1980); and the absence of habitation in the uplands and within the central Columbia Basin. These data, when compared with a fauna rich in whitetailed deer, mussels, and salmon, and seen in a setting where the river levels are raised, river velocity slowed, and riparian flora expanded, indicate a dispersed pattern of settlement in which foraging territories were small. Because people exploiting territorially restricted resources (such as whitetail deer, mussels, and various plant species) and foraging opportunistically may readily have depleted these resources, the place of residence was moved frequently; hence the apparent high population of archaeological sites. In addition, we suggest that with the riverbed raised and water slowed, rapids and other optimal fishing sites, were less numerous than in later times. People would either have aggregated at the few remaining rapids during the fishing season, or they would have used a fishing technology that allowed them to gather salmon from many less-than-optimal localities nearer their homes (net fishing, for example).

By contrast, Leeds (1981) and many other students of Columbia Plateau prehistory (e.g., Galm and Hartmann 1981) believe that once pithouses appeared, the general pattern of human existence remained little changed for over 4000 years. Schalk viewing the subject from a general belief in the gradual increase in human populations through time, expects change to result from resource intensification precipitated by population pressure (cf., Christenson 1980).

<u>Research Problems</u>: This time period, called variously the Indian Dan Phase and early Cassimer Bar Phase (Grabert 1968), Toucannon Phase (Leonhardy and Rice 1970), Hudnut Phase (Jaehnig 1983b), or Frenchman Springs (Swanson 1962) is one of the most intensively studied periods in the prehistory of north-central Washington (Salo 1983). The University of Washington has excavated many components belonging to this period (Leeds et al. 1981). Consequently information from sites of this age

is likely to be redundant with data already collected and thoroughly studied. However, several kinds of information are lacking, particularly with regard to fish utilization. We know little about the fishing technology of this period, or whether fishing was carried out from seasonal fishing camps or from permanent encampments (see below) used during most seasons. We do not know which species of salmon were being most heavily exploited and which were being preserved for storage and winter consumption. Finally, our hypothesis of central-based, territorially-restricted, foraging/collecting adaptations needs further testing.

No housepit from this period, or for that matter, any other period, has been completely excavated as a unit in the middle or upper Columbia. Consequently we do not know 1) details of house construction, 2) internal layout (including storage technology), or 3) the number or organization of families occupying a housepit. Therefore, any housepit with one or more undisturbed floor levels and still-distinct pit walls has great potential. Few pithouses in the Chief Joseph Reservoir met these criteria, primarily because of extensive rodent disturbance of the soft sands and wind- blown silts usually filling the pits (Jaehnig 1983; Lohse 1983a).

Warmer, Drier Conditions Return: 2500 to 200 BP.

By 2500 years BP, worldwide temperatures began to rise and precipitation in Eastern Washington and the Rocky Mountains declined. The river stopped building its floodplain and began a period of erosion and downcutting. With lower water levels and a declining area of floodplain, the riparian zone nearly disappeared. Rapids were re-exposed. Migratory mule deer almost completely replaced the territorial whitetails in the Chief Joseph area (Livingston, personal communication). The steppes became less productive; small streams became more ephemeral and edible, starchy roots may have become restricted to a few, reasonably well-watered areas in the uplands. In general, an environment with fairly dispersed, evenly distributed resources seems to have changed into one in which resources were more concentrated in a few, highly productive patches.

At the beginning of this period, the archaeological occupation census shows a sharp decline (Salo 1983). In fact very few sites in the Chief Joseph area or the mid-Columbia date between 2500 and 1600 years BP. By contrast, activity in the central Columbia Basin, such as Grand Coulee, Moses Lake, Quincy Basin, and Saddle Mountain suddenly intensified (Chatters 1980; Osborne 1967). Hunting, root gathering, and stone quarrying and processing sites abound. There are even a few housepits along Moses Lake that may belong to this period (Daugherty 1952). By contrast, activity in the canyons and bluffs along the major rivers declines (Chatters 1980, 1983). Human life in this 900 year span from 2500 to 1600 years ago appears to have differed little from the following 1300 years of prehistory. In various areas this period is known as early Harder (Leonhardy and Rice 1970), late Cassimer Bar (Grabert 1968), early Coyote Creek (Jaehnig 1983) or Quilomene Bar and/or early Cayuse (Nelson 1969; Swanson 1962).

Occupation numbers jump sharply at 1600 BP and quickly approach levels found during the Frenchman Springs Phase (Salo 1983).(1) Use of the uplands and the Columbia Basin for root gathering, hunting, and some winter habitation continued into historic times (Osborne 1967; Ray 1933; Smith 1977). Winter habitation continued to involve housepits, which occur in great numbers on river bars where driftwood collected year after year and where the winter sun is not blocked by bluffs (Greengo 1982; Cleveland 1976; Osborne 1952; Grabert 1968). These housepits rarely if ever occur singly on upper terraces or in small, tributary canyons. Houses were reused repeatedly for decades (e.g., 45OK5 Lyman 1976; 45OK165 this volume). Besides winter campsites, fishing encampments and small, briefly occupied hunting and large-mammal processing sites occur. Fishing camps, located at rapids and stream

confluences, show evidence of repeated, long-term use. Subsistence resources continued to include salmon, deer, and various wild roots (Dancey 1979). Occasionally other large mammals took a prominent place in the diet (e.g., mountain sheep [Livingston 1983]; or bison, [Schroedl 1973]).

Compared to the previous, Frenchman Springs Phase, the settlement pattern of this period called Cayuse (Nelson 1969), Coyote Creek (Jaehnig 1983), or Chiliwist (Grabert 1968) and late Harder and Piqunin (Leonhardy and Rice 1970) was characterized by a new kind of mobility (Chatters 1983). Before, people lived as small, dispersed groups, foraged in small territories along the rivers and moved their winter residences frequently. During the later period they aggregrated into fewer, larger, winter groups, and exploited larger territories including both riverine and upland environments. The same residential sites were occupied, at least intermittently, for centuries. Mobility in this latter period consisted of task groups dispersing seasonally to food collecting sites and then returning to the same winter base camp year after year. This is known as a logistic strategy (Binford 1980). We suggest (cf., Chatters 1983) that these changes occurred in response to a warming, drying climate with its consequent increase in the patchiness of food resources (resources concentrated in a few, widely separated geographic locations). Nelson (1973) on the other hand, might attribute the change to immigration of a new people, the Salishan speakers, into the area.

Research Problems: While the archaeology of this period has been the most intensively studied of any in the region, there are several unanswered questions. First, so little is known about the 2500-1600 BP interval that we are hard pressed to cite a cause for the sudden decline in site numbers. Potential causes include: selective erosion of these sites due to renewed downcutting by the rivers; a population decline caused by abrupt, wholesale change in the environment, and a shift in foraging emphasis away from the river. Any site which provides a good set of data on floral and faunal resources or paleoenvironmental conditions (especially geologic data on the river's behavior) would deserve special attention.

Basing their argument on an understanding of salmon ecology and a general belief in the continuous rise in human populations, Schalk and Cleveland (1983; Schalk personal communication) posit that we should see a decrease in large mammal utilization and a change in salmon species utilization with time. Specifically, they suggest that with increasing populations, people would have been less able to live through winter on the fall chinook salmon (chinook are the most storable of salmon because they arrive after the heat of summer has passed) because this fish is comparatively rare on the upper Columbia. When populations exceeded the ability of these fish to support them, they should have turned more to the larger, mid-summer run of sockeye (less storable due to its arrival in hot weather). All other things being equal, Schalk's postulate of continuous population increase would be supported if a change in salmon utilization is indeed found.

Equestrianism and Euro-American Contact: after 200 BP (1750 AD).

Spanish horses, traded from the southwest to the Shoshone and then Nez Perce, Cayuse and Salish tribes of the Plateau arrived by the mid eighteenth century. Shortly thereafter, disease, fur traders, and then settlers arrived in rapid succession. The effect on local cultures was severe.

First, with the arrival of the horse, people became even more mobile in their seasonal foraging rounds, often traveling hundreds of miles to prime hunting, fishing, berry picking and root digging grounds. Many of them turned from their traditional pithouses to more portable, although less heat efficient, mat-covered longhouses, and turned also to a pattern of residential mobility. The mat house probably was already a

shelter used seasonally by task-oriented foraging groups at root digging, fishing, and other localities. As part of an already-mobile aspect of the seasonal foraging round, the mat house, enlarged, was readily adaptable to the increased mobility provided by horses.

Eurasian diseases (cholera, smallpox, and measles) began to strike the area periodically by the last quarter of the eighteenth century, devastating native populations. Although the details are uncertain, the resulting population decline may have had a severe impact on foraging strategies and on sociopolitical organization.

The fur trade brought new hunting weapons and a reliance by some peoples on the developing world-wide market economy. This new technology and the need to maintain it either through trade in horses or animal skins must have had a destabilizing effect on the local ecosystem. Certainly, overgrazing by herds of horses raised by the Okanogans (Elliott 1914; Ross 1849) must have seriously altered the local numbers and distribution of grazing mammals such as elk and mountain sheep. Ecological changes, like local game depletion, may have further promoted group mobility and increased the size of territories in which each human group foraged.

Change continued throughout the nineteenth and twentieth centuries, with native peoples becoming increasingly like the Euro Americans in their economic systems. Change continues today.

Despite its recency, the archaeology of this contact period is virtually unknown. Only a handful of sites (two longhouses in Wanapum Reservoir [Greengo 1982], 45OK2 above-ground mat lodges in the Chief Joseph area [Campbell 1983], and perhaps a few larger rootgathering rendezvous like 45KT301 the Kittitas Valley [Ross 1849] (45OK2) has been intensively studied.

Research Problems: Many of the above statements (about social, political, economic, and ecological effects of equestrianism and Euro-American contact) are hypothetical. Because so little research has been directed toward this period, virtually any site of this age that contains information on foraging technologies, subsistence, dwelling construction, or village patterning, has great information potential.

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Appendix A

SITE REPORTS

45DO189, 45DO190/191, 45DO394, 45DO12M,

45OK165, 45OK193, 45OK198, 45OK199,

45OK205, 45OK207, 45OK208, 45OK219

by

James C. Chatters

and

Dianne E. Semko

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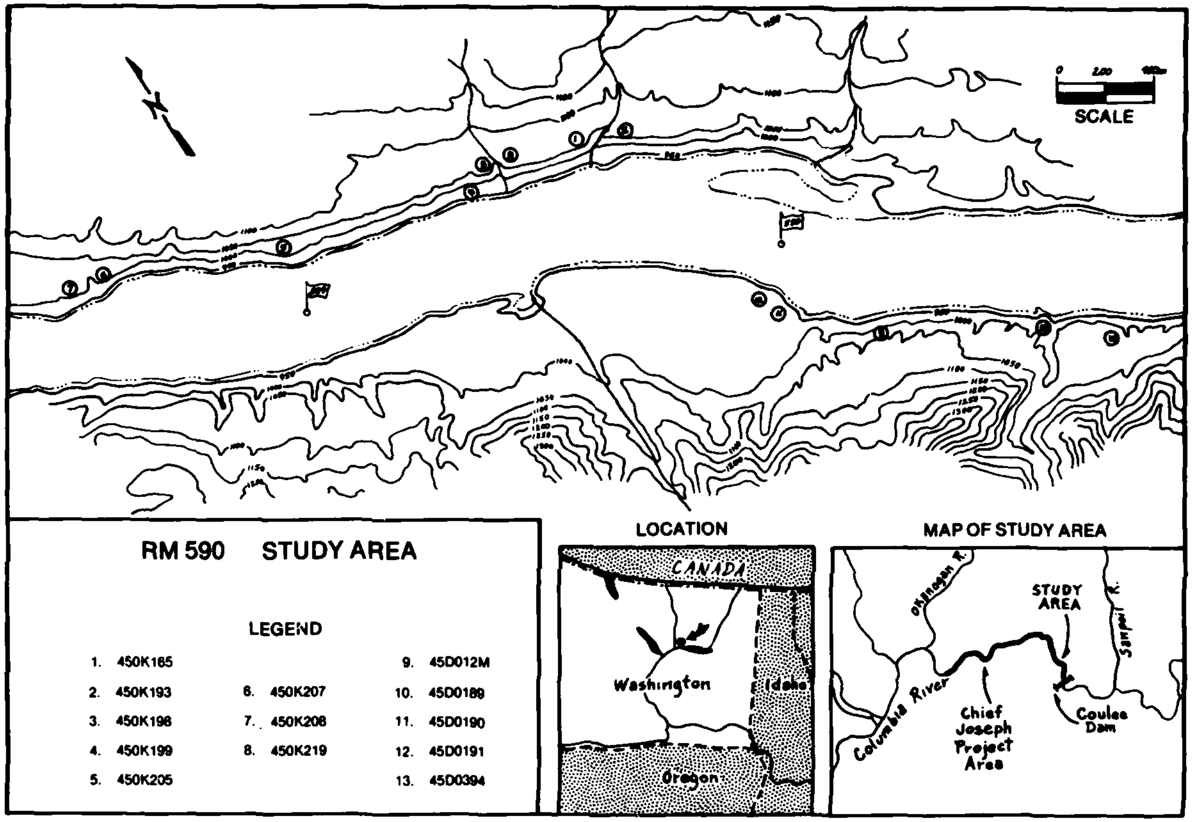


Figure A-1. The RM 590 Study Area, showing the locations of tested sites.

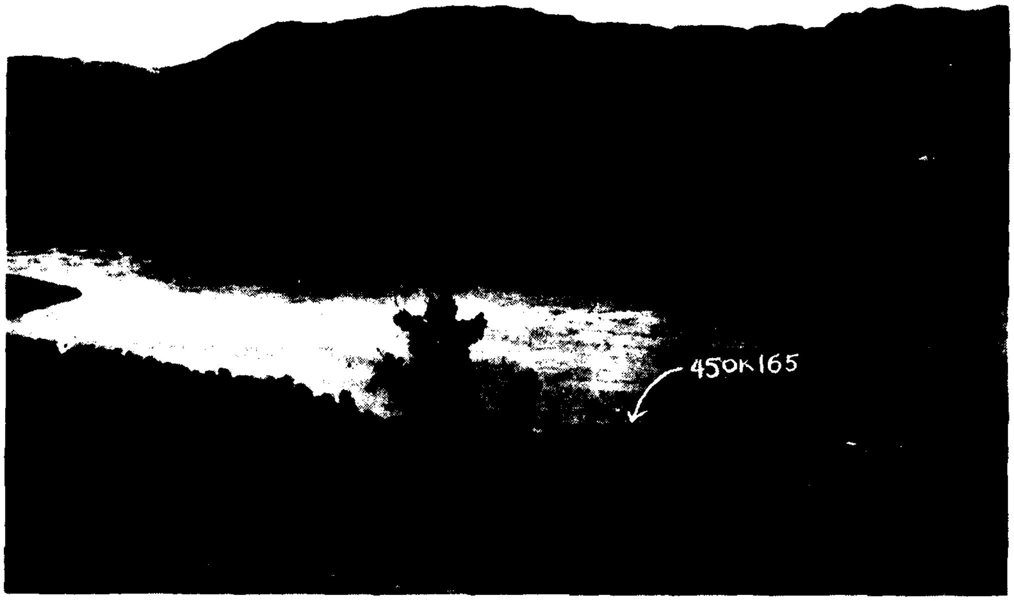
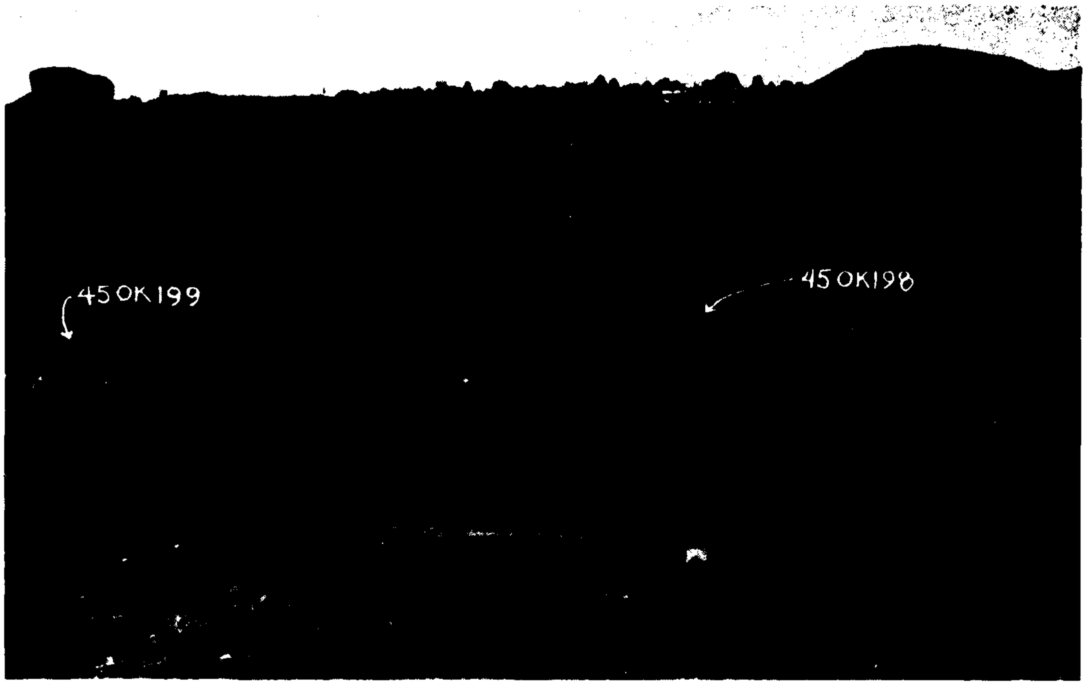


Plate A-1. RM 590 archaeological sites. Upper: 45OK165 and 45OK193. View is to the southeast. Lower: 45OK198 and 45OK219. View is to the southwest.



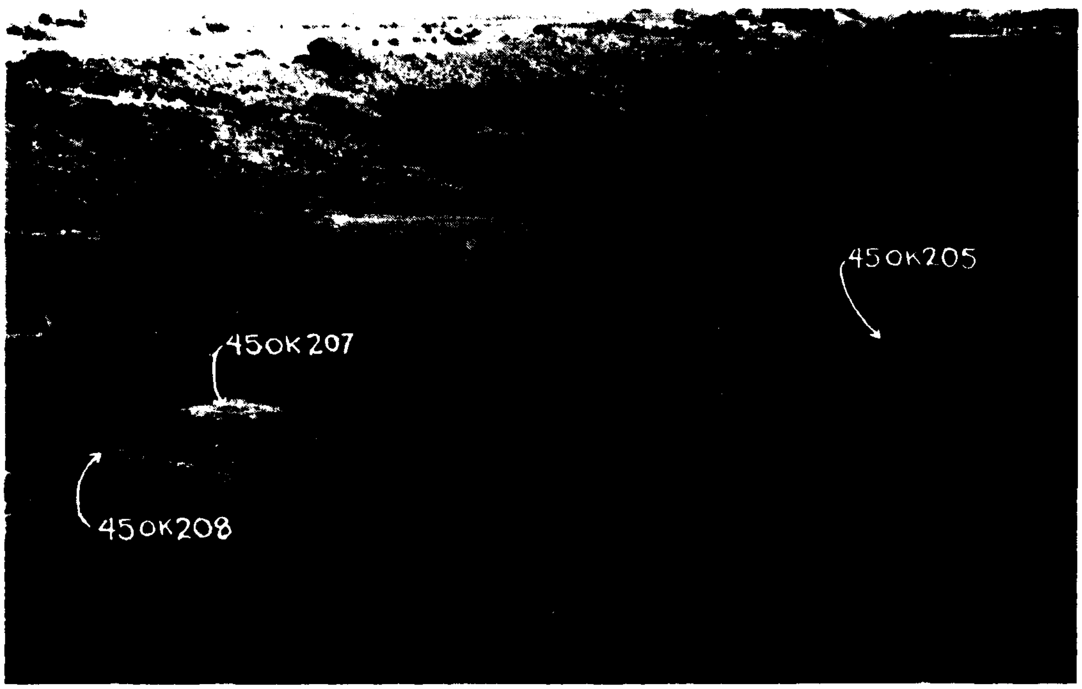
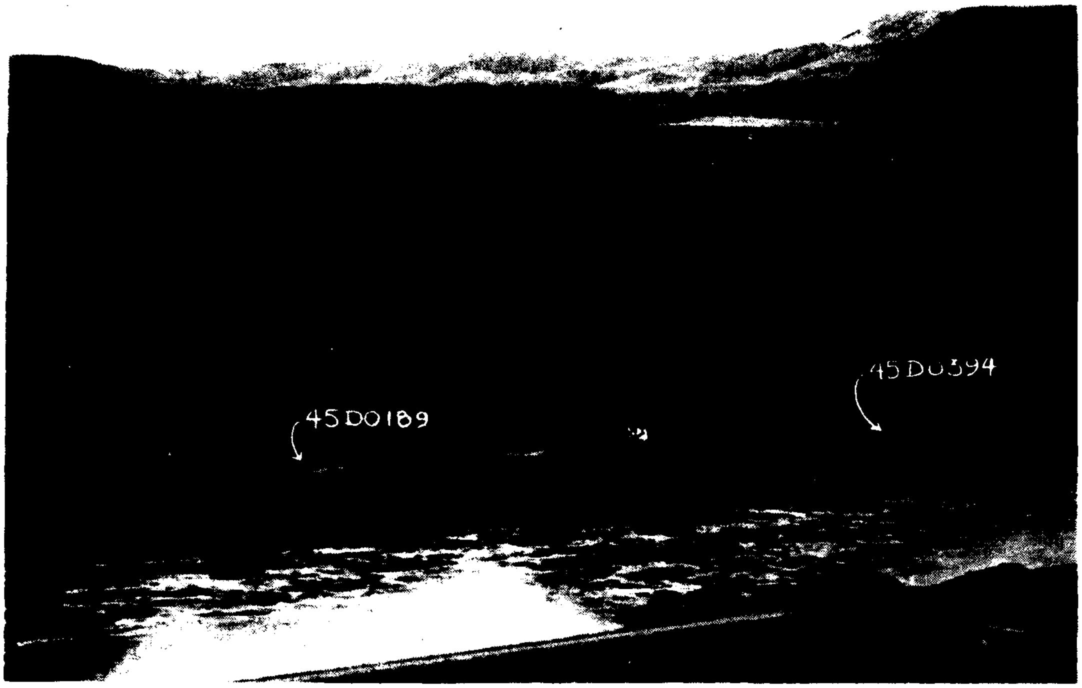


Plate A-2. RM 590 archaeological sites. Upper: 45OK196, 45OK197, (not in this report), 45OK198 and 45OK199. View is to the north. Lower: 45OK205, 45OK207 and 45OK208. View is to the northeast.



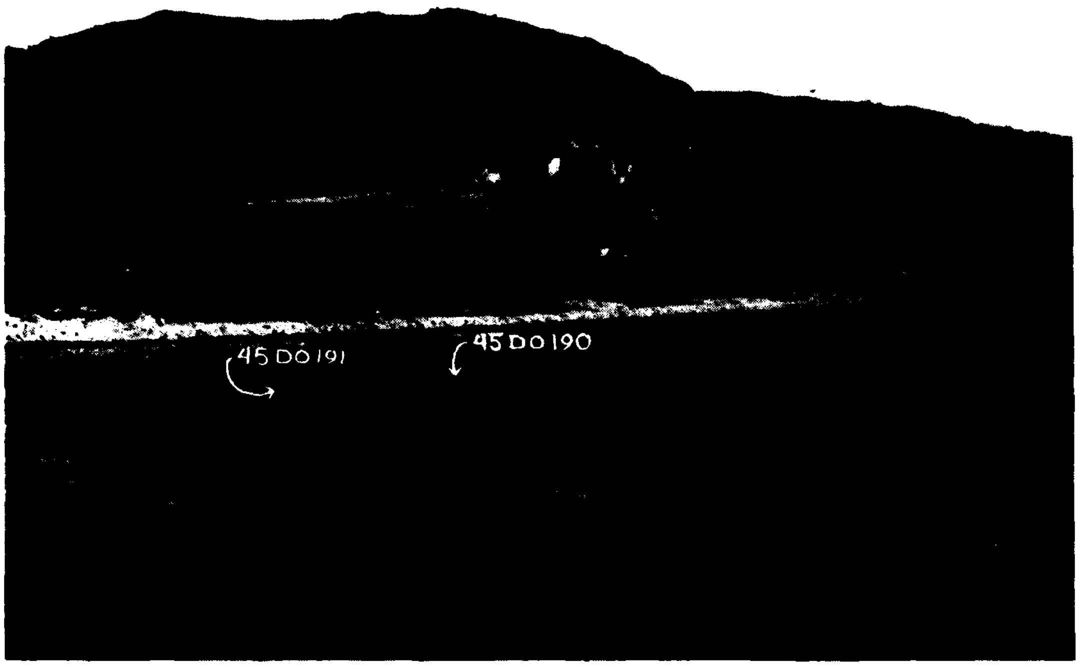


Plate A-3. RM 590 archaeological sites. Upper: 45DO189 and 45DO394. View is to the south-southwest. Lower 45DO190/191. View is to the northeast.

45DO189

Site 45DO189 consists of a single housepit and associated refuse, extending 28m along the eroding edge of the T2 Terrace 1080m upstream from River Mile 590 (Figure 189-1). The site is on the south bank of the Columbia River in the NW 1/2, NW 1/4 of the SE 1/4, Section 7 in Township 29N, Range 31E (W.M.). Surface elevation is 314m, m.s.l. (1020') and is approximately 27m (88') above the pre-dam river level.

The nearly-circular housepit depression is up to 75cm (29") deep and 10m (32.3') in diameter; surface artifacts are scarce, but fire broken rock and a few lithic flakes can be seen protruding from the near-vertical terrace face between 20 and 60cm below surface.

Vegetation is primarily sagebrush, with a thin understory of bunchgrass (cf. Poa secunda). There is no evidence of historic period disturbance to the site and its environs; it has never been plowed. Inspection of aerial photographs taken in 1930 and 1982 indicates that up to 4m of the terrace have been lost to erosion in the last half century.

Currently owned by the U.S. Bureau of Reclamation, the site was formerly owned by Senator Nat Washington, Ephrata.

Previous Research.

The site was discovered and recorded by Lyman (1976). In 1977, working under contract with the Bureau of Reclamation, Prolysts, Inc. conducted test excavation and preliminary evaluation of the site (Bryant 1978). Bryant excavated a single 1x2m test in the housepit depression, near the western edge. His excavation was taken to 1.0m below surface; artifacts were rare. Further work was recommended due to the apparent uniqueness of the site (a single housepit on a high terrace in contrast to other multiple-house, lower elevation sites nearby).

In April 1982, Bureau of Reclamation archaeologist Terry Zontek, and Seattle District, COE, archaeologists David Munsell and Jonathan Maas, conducted a second test. They placed a 1x1m test pit near the terrace edge 4m north of the housepit (Figure 189-1) and excavated four shovel tests in the same vicinity. Post holes contained little, but artifacts were numerous in the test pit. Fragments of fish and mammal bone, fire broken rock and flakes of opal, jasper and quartzo-feldspathic schist predominated; shell was rare. Based on artifact frequencies, the occupation zone appeared to be between 20 and 50cm below surface outside the housepit, corresponding with evidence in the cutbank. No temporally diagnostic artifacts were found.

Techniques.

Prior to testing in July, 1982, Mr. Robert Huggins of Spectrum Geophysics conducted a magnetometer survey of a 20x20m block covering most of the site area (Appendix B). He noted a series of large and small-scale magnetic anomalies in and around the housepit. The pit itself appeared as a negative anomaly, with large, elongate, east-west trending positive anomalies just to the north and south. Six smaller, positive anomalies could be discerned to the south of the depression, with half of these around the house rim.

After Huggins completed his survey, we placed six 1x1m test pits on a 10m grid to ascertain component depth and horizontal extent (Figure 189-1). Vertical control was maintained in 20cm arbitrary levels. In combination with the single test unit excavated north of the pithouse depression by Seattle District archaeologists, and the 1x2m pit excavated in the depression by Prolysts, the results of this small

number of tests confirmed that the site was not over 28x15m in extent (Figure 189-2). We then excavated six additional 1x2m pits, situated to: 1) obtain more artifacts from the areas northeast and east-southeast of the housepit, which preliminary tests had shown to be the principal non-house areas of artifact concentration (2 units) and 2) to investigate magnetic anomalies north and south of the house (one 1x2m and one 1x1m unit). We then excavated a broken trench line across the pithouse depression consisting of two 1x2m units intersecting house walls and a 1x4m trench consisting of the pit excavated by Prolysts, Inc. and a 2m extension thereto. Vertical control inside the house pit was in 10cm levels. All pits were excavated to late Pleistocene/earliest Holocene fluvial deposits or glaciolacustrine silts of the Nespelem Formation.

Physical Stratigraphy.

A schematic of site stratigraphy is shown in Figure 189-3; Figure 189-4 is an example of actual stratigraphy. Deposits represent a sequence of deposition and erosion events so that not all time-stratigraphic units are common to third terrace level (T2) are represented here.

T2 has been eroded into horizontally-bedded silts of the Nespelem Formation (Flint 1935), a time-stratigraphic Unit 1, here designated Stratum 6. Between the cut bank and 15m south thereof, the silts are unconformably overlain by cobbles and gravels left by the ancestral Columbia River (Stratum 5). Farther to the south, gravels are absent, with the first post-erosion stratum consisting of fluvial sands (Stratum 4). These magnetite-rich sands represent low-bar channel bank deposits and also overlie the river gravels to thicknesses of up to 60cm. Gravels and low-bar sands represent time stratigraphic Units IV and Va. Stratum 2c is a massive mud slide deposit of reworked Nespelem silts and clays (time stratigraphic unit Vc) and appears to unconformably overlay the fluvial sands. This deposit is up to 30cm thick and very compact.

Above is Stratum 3, a massive silty fine sand that lacks Mazama tephra. It appears to be wind-reworked upper-bar alluvial deposits of time stratigraphic Unit VI. This sand is unconformably overlain by a mud slide deposit of Nespelem silts and clays of varying thickness (up to 20cm).

Above this second mudflow unit is an up to 80cm thick layer of massive aeolian sand (1b) with pebbly colluvium intermixed. Rodent disturbance is extensive here, but penetrates little into the mudflow deposit beneath. This stratum is also free of Mazama tephra and belongs to time stratigraphic Unit XI, dating between 4700 and 2500 BP. A third, irregularly distributed mudflow layer (2a) occurs within Stratum 1b at the usual depth of 60cm to 1m. The single occupation zone overlies the uppermost mudflow deposit at a depth of 20-50cm (figure 189-4).

A recent sand (stratum 1a), apparently both colluvial and aeolian in origin caps the deposit and almost certainly represents the increased erosion occasioned by overgrazing of the area in historic times (Time Stratigraphic Unit XX).

Cultural Stratigraphy.

As Figures 189-2 and 189-4 show, 45DO189 is a single occupation site in which all artifacts are concentrated within 10m of one housepit. Although some debris occurs in the uppermost 20cm and occasionally is found in deeper, levels nearly all bone, fire broken rock, flakes and shell fragments occur in one depth zone, 20-60cm below surface (Figure 189-4). Horizontal distributions of chipped stone (lithics) and bone

are nearly coincident and show their highest concentrations in the house floor deposit, with secondary highs to the north and southeast of the house. No features were found in non-house deposits, possibly because of extensive rodent disturbance.

Chronology.

The stratigraphic position of artifacts in the upper one half of stratum 1b, indicates the site was occupied between 4700 and 2500 BP, probably during the latter half of that period (ca. 3500-2500 BP). The four projectile points found there include single examples of Lohse's (1983) 11b, 12a, 12b and 13c, all of which were common between 3500 and 2500 BP. These matching stratigraphic and stylistic dates are confirmed by the single radiocarbon date thus far obtained from the house pit floor at 45D0189: 2960+-80 BP (Beta 5894).

Artifacts.

Features. We uncovered only one feature at the large, surface-evident housepit. Seattle District archaeologists reported finding a concentration of mussel shell north of the housepit, but this concentration was not reported as a feature.

> Houses. Our excavations revealed a single, large housepit feature, within which was a hearth area (Figure 189-5). The circular or square house is just over 9m across, has vertical walls and a nearly-level floor approximately 1.3-1.4m below the original land surface. The pit excavation was cut through aeolian and upper-bar sands, mudflow deposits and low-bar, magnetite-rich sands to the gravel surface below. Artifacts are concentrated within 20cm of the single floor deposit, with salmon bone and large fragments of mammal bone around the circumference of the floor and a dispersed hearth area at least 2m in diameter in the center (radiocarbon date Beta 5894 from this feature). Chipped stone and fire cracked rock are common in and around the hearth. The pit walls, cut through compact, clay-rich deposits, are in good condition.
>
> Considering the bioturbation to which deposits outside the house have been subjected, it is surprising how intact the house walls and floor have remained. The house floor, itself a mixture of silty medium sand, organic material and artifacts, has been sealed by a clay-rich slope wash deposit shortly after abandonment and thus resisted disturbance. We excavated through the house floor only in a 1m square area, preferring to leave the rest in pristine condition.

Use-Wear.

Of the 410 chipped, pecked and ground stone artifacts, 29 were either projectile points or showed use-wear (Table 189-2). Tool Classes 16 (41%, N=12), 3 (24%, N=7) and 19 (15%, N=4) comprise most of the tool assemblage defined by wear patterns. Classes 1, 4, 8 and 15 are present, but rare. These tools indicate that heavy cutting, often of hard materials, (Class 16, bifacial chipped and crushed wear on convex edges), and light scraping (Class 3, unifacial chipped wear on a convex edge) were the most common activities performed with stone tools.

Hunting, represented by Class 19 (projectile points) was an important activity of the site's inhabitants.

Traditional Common-Sense Tool Categories.

The thirty-two objects were assigned to traditional tool categories, including 4 projectile points (12%), 2 bifacial (6%) and 7 unifacial (22%) utilized flakes, a scraper (3%) 2 spokeshaves (6%), 14 tabular quartzite knives (44%), an anvil (3%) and a bird-claw pendant.

Faunal remains. Seventeen mussel shell hinges and 640 bone fragments were recovered from the site during CWAS excavations. All mussels were *Margaritifera falcata*. Only 53 vertebrate bones were identifiable to a taxon below the class level (the bird claw pendant has not yet been identified); another seven mammal bone fragments were categorized according to size (all deer size). Twenty-one of the identified specimens are resident rodents (gopher). The remaining assemblage is dominated by salmonids (N=18, 55%) and deer (N=9, 22%). Bison, mountain sheep, pronghorn and bird are the only other non-rodent taxa represented.

Seasonality.

No direct information from this occupation can be used to determine the season of use, so we must fall back on the ethnographic record. According to Ray (1932) pithouses were base camps occupied primarily in the winter. During that time the main subsistence activity was the hunting of deer and other ungulates in the river breaks and nearby mountain front. Stored foods, notably salmon and various edible roots, were the mainstay of winter survival. Since 45DO189 includes a pithouse, the floor of which is littered with deer and salmon bone, we might be correct in concluding that this was a winter habitation. However, we must not neglect the possibility that people lived on site periodically throughout the year, but stayed in surface shelters outside the pithouse in warmer seasons (see discussion on 45DO190/191). Our faunal assemblage, which comes almost entirely from the protected environment of the house pit floor, may merely be biased toward the season during which the pit was used as a dwelling, and/or may reflect their use of the cool pithouse as a storage bin for all seasons. Salmon bone may actually be indicating summer and fall, not winter habitation.

Lithic Material Use.

45DO189 shows the highest frequency of opal/opaline of any occupation in this study (45%, N=154). Jasper is second at 31% (N=62); quartzite is 15% (N=62) of the assemblage. Basalt is nearly absent (N=6).

Interpretation.

45DO189 was inhabited briefly by a small group of people for a continuous period about 3000 years BP (between 845 and 1420 BC). They probably were resident throughout the winter, but may have been present during other seasons. Principal elements in their meat diet were salmonid fishes (most likely chinook salmon) and deer.

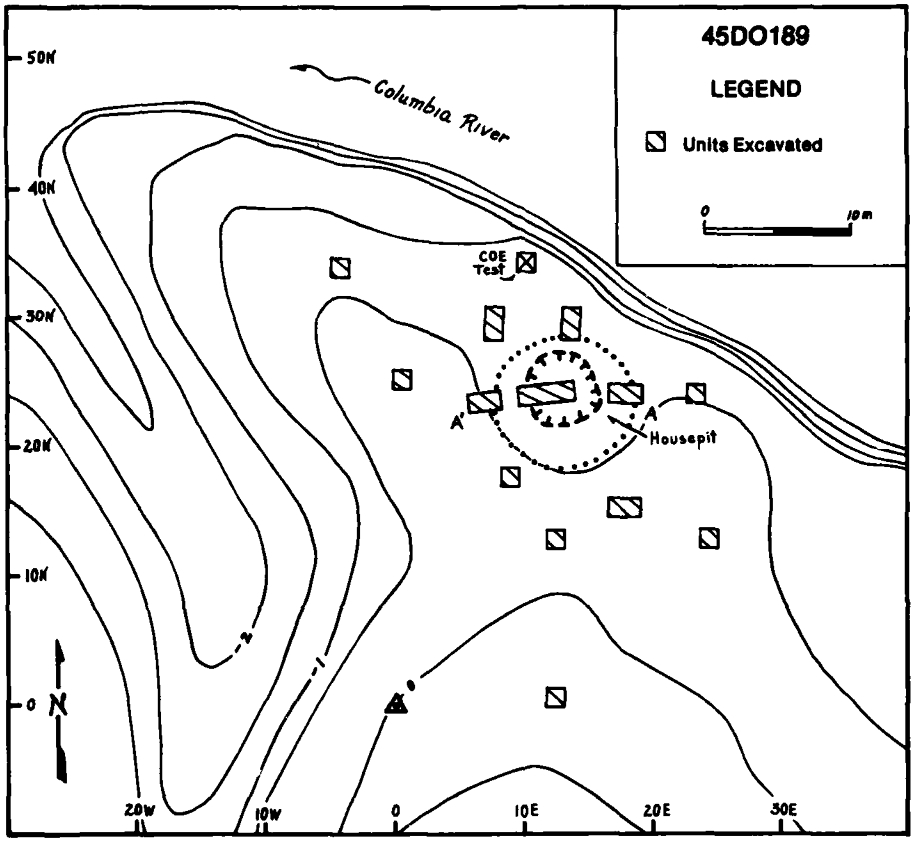


Figure 189-1. Topographic maps of 45DO189 showing test pit locations.

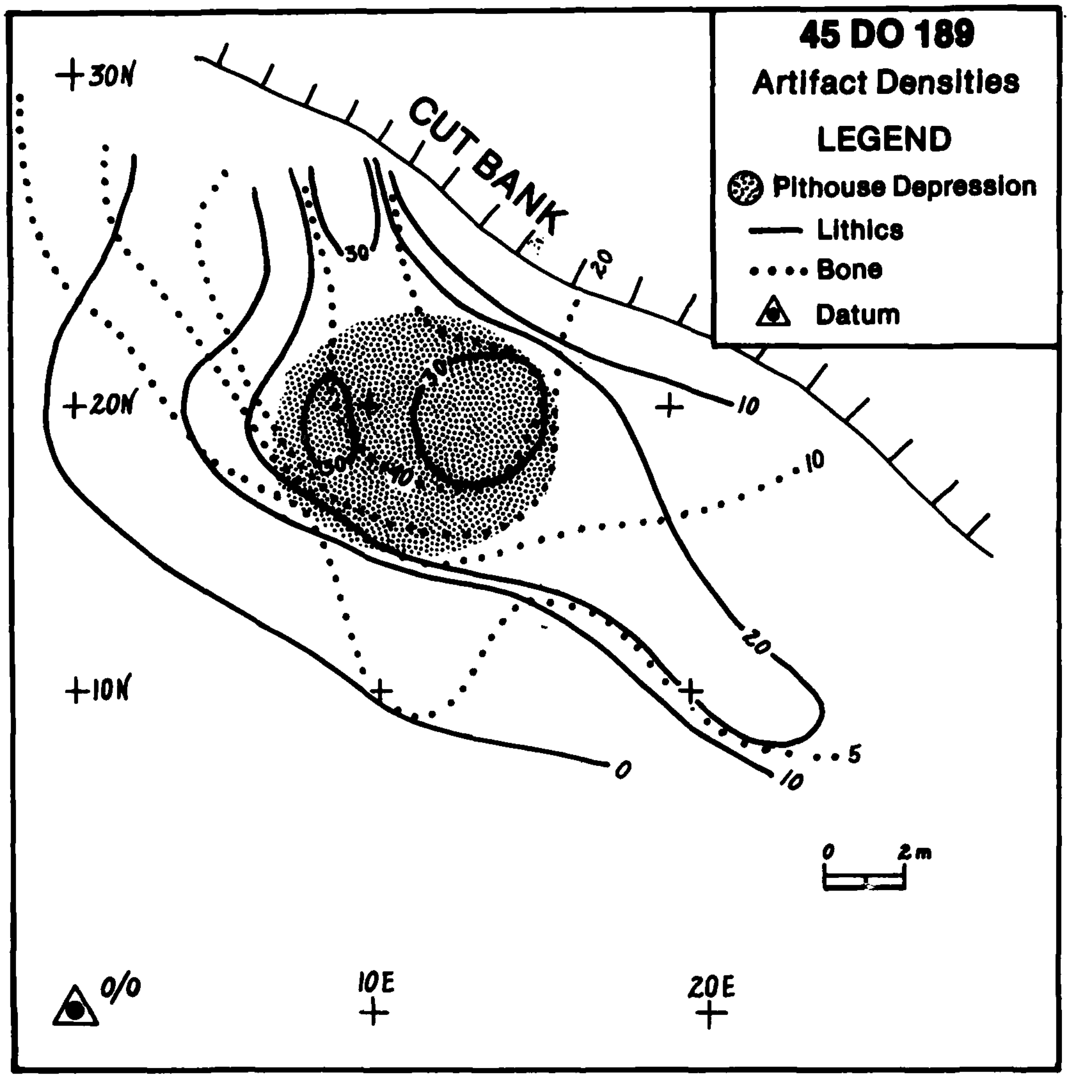


Figure 189-2. Map of lithic and bone artifacts at 45DO189. Contour intervals are variable; units are numbers of objects.

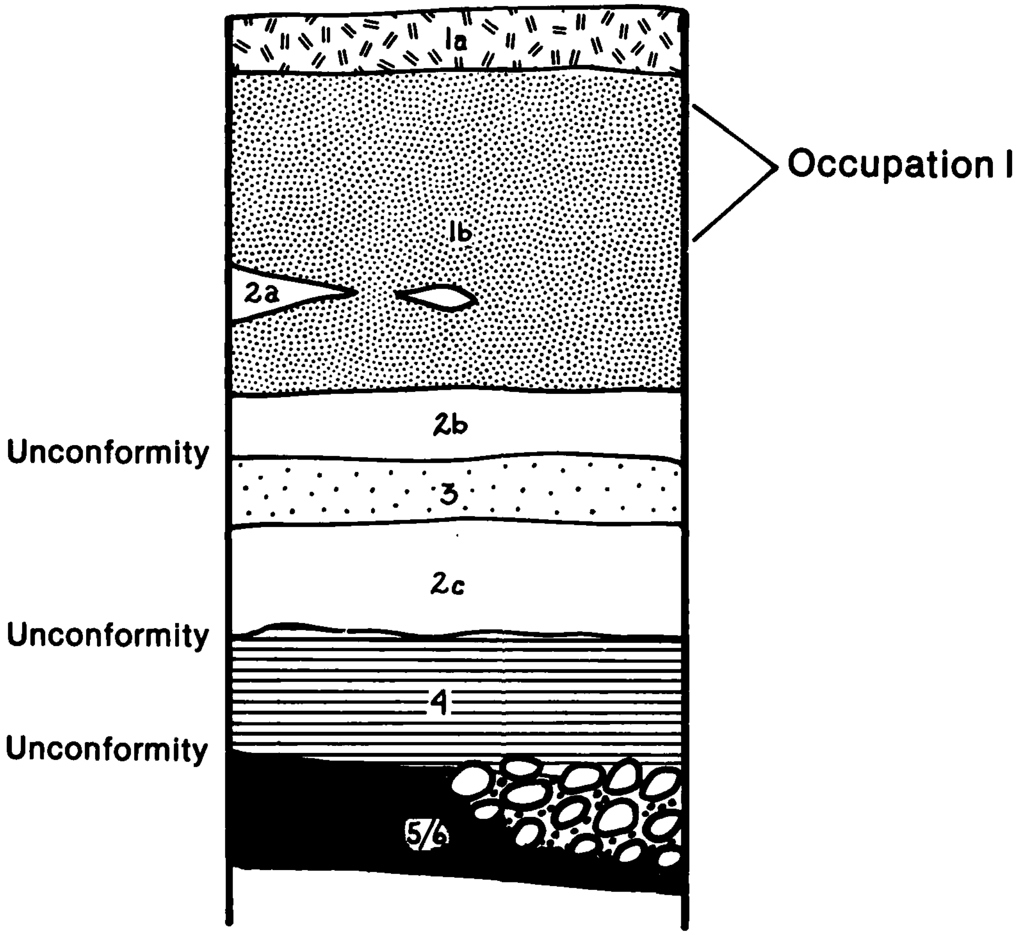


Figure 189-3. Schematic of site stratigraphy at 45DO189.

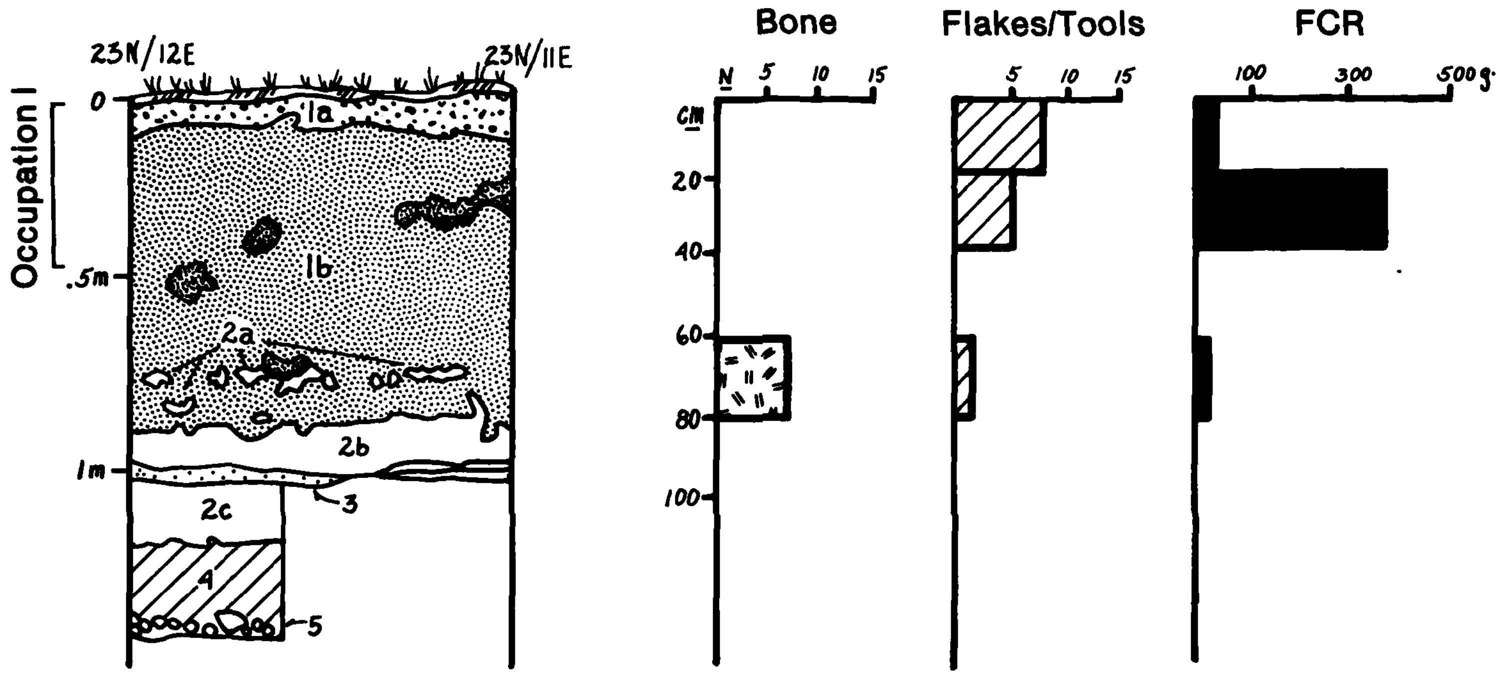


Figure 189-4. Actual profile from 45DO189, matched with vertical frequency graphs for bone, lithics (flakes/tools) and FCR. The single peak in FCR weight corresponds with the occupation zone; the higher peak of bone frequency is endemic rodent.

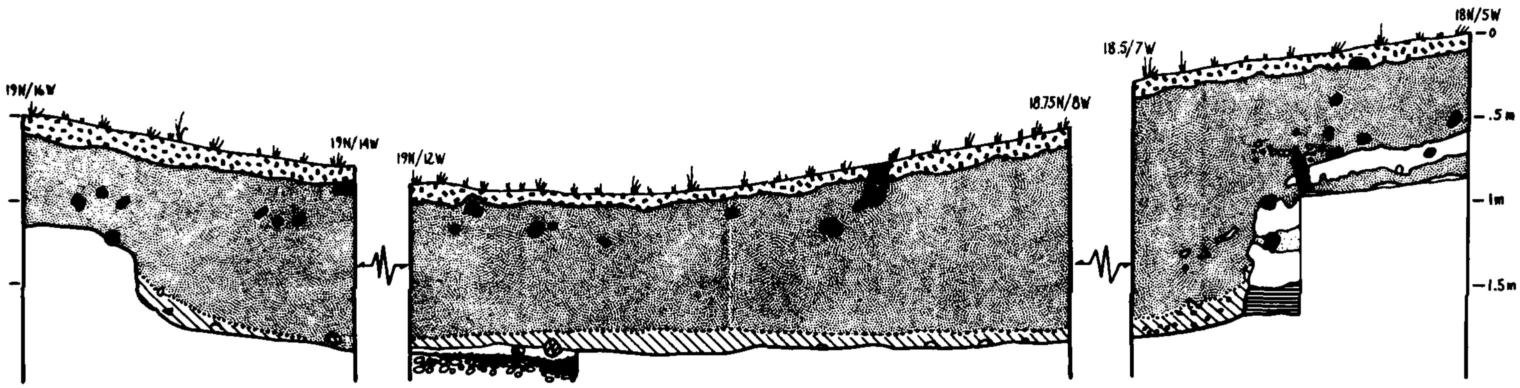


Figure 189-5. Stratigraphic cross-section of House 1 at 45DO189. A and A' refer to Figure 189-1. See Figure 189-3 for key to stratum designations.

Table 189-1. Description of Geologic Strata at Site 4SD0189.

Stratum	Description
1a.	Brown fine silty sand with coarser particles. Slightly soft with gradual, wavy boundary. Color: 10YR5/4. Contains lenses of finer material.
1b.	Gray-brown very fine silty sand with coarser particles to pea gravel size. Slightly hard with abrupt, irregular boundary. Color: 10YR5/4. Occupation I occurs in this stratum.
2.	Tan silts intermixed with fine sands. Hard to slightly compact with abrupt, broken boundary. Lies unconformably within Stratum 1b. Color: 2.5Y8/2.
3.	Pale-brown fine-medium sands with few coarser particles. Slightly hard to sloghtly soft with abrupt, smooth to irregular boundary. Color: 10YR6/3.
4.	Gray medium to coarse sand containing numerous laminae and lenses of magnetite. Loose with irregular boundary. Color: 2.5Y6/2.
5.	Rounded cobbles, gravel, boulders and coarse sand, slightly loose to compact. Boundary clear and irregular. Color: variable.
6.	Tan bedded silts, compact with indeterminate boundary. Color: 2.5Y8/2.

TABLE 189-2.

SITE 45DO189

SUMMARY OF CONTENTS

Category	OCCUPATION I	II	III	IV	V	Unassigned
Volume	14.20					
TSU Position	Upper XIc					
Radiocarbon Age	2960±80					
Cultural Style Age	2500-3500					
Age Estimate	2900-3100					
FCR						
Count	306					
Weight (kg.)	13.7					
Mean	0.044					
Lithics						
Flakes	342					
Common sense categories	32					
Utilized flake/chunk	7					
Amorph. fl. object	1					
Biface	2					
Projectile point	4					
Scraper	1					
Spokeshave	2					
Tabular knife	14					
Anvil	1					
Projectile Point Types						
5						
6						
7						
8						
9						
10						
11	1					
12	2					
13	1					
14						
15						

SITE 45DO189

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class						
1	2					
2						
3	7					
4	1					
5						
6						
7						
8	1					
9						
10						
11						
12						
13						
14						
15	2					
16	12					
17						
18						
19	4					
Material						
Opal	154					
Jasper/chert, chalcedony	111					
Basalt	6					
Quartzite	22					
Other	9					
Features						
Hearth	1*					
Shell/FCR midden	?					
Pits						
Earth oven						
Housepit	1					
Form	Circular or square					
Diameter or L/W	9m x (9m?)					
No. Floors	1					

*Located within a pithouse

SITE 45DO189

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains	604					
Unidentified Bone	550					
Unburned						
ct.	502					
wt. (g.)	184.94					
Burned						
ct.	48					
wt. (g.)	19.73					
Identified Bone	54					
Unburned						
ct.	54					
wt. (g.)	50.73					
Burned						
ct.						
wt. (g.)						
Economic Fauna						
Artiodactyla						
Bos taurus	1(1)					
Ovis aries						
Bison	1(1)					
Ovis canadensis	1(1)					
Odocoilcus sp.	9(1)					
Cervus canadensis						
Antilocapra americana	2(1)					
Carnivora						
Canis spp.						
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris						
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatum						
Reptilia						
Chrysemys p.						
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45DO189

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae	18					
Cyprinid/ Catostomidae						
Aves	1					
Endemic Rodents						
Spermophilus						
Microtus						
Lagurus c.						
Peromyscus						
Perognathus						
Thomomys	21(3)					
Mollusca						
Margaritifera falcata	17					

1. NISP (MNI)

45DO190/191

These sites are on small, triangular sandy knolls at the upper end of Sanderson Creek Bar at River Mile 590 (Figure 190/191-1); their elevation is approximately 300m, m.s.l. (975'), about 13m (43') above the pre-dam river level. These sites are on the Columbia River's south bank in T30N, R NE E, SE 1/4, NE 1/4, NE 1/4 of Section 12. At first, the knolls appeared to be the eroded remnants of sand dunes, but closer inspection revealed them to be tiny remnants of the second terrace level above the river (Tl), isolated by historic mining activity and erosion. The larger knoll, containing 45DO190 is an equilateral triangle approximately 50m on a side with its base parallel to the Columbia River. An erosional channel, over 35m at its narrowest point, separates this knoll from the smaller triangular remnant in which 45DO191 occurs. To the north and west (downriver) of 45DO191 are the telltale loaf-shaped gravel mounds left by placer miners in the 19th century. Mussel shell, fire broken rock and stone flakes are thinly scattered along the riverbank and erosional channel between the two site areas, leading us to suspect that the archaeological deposits once were continuous. Excavations corroborated this supposition, leading to the designation 190/191 for this site.

Overall, the site extends for 100m parallel to the Columbia River, with a maximum width of 50m. Only a fraction of this area contains intact archaeological deposits. Both sites are on Bureau of Reclamation land; there is no tenant.

Previous Investigations.

These sites were recorded in 1976 by Munsell, Salo and Einarsen and subsequently tested by Prolysts, Inc. (Bryant 1978). Munsell et al. reported two possible housepits on the surface of 45DO190 and a root cellar on 45DO191. Bryant described the housepits as follows:

> A housepit depression 9 meters in diameter and 1 meter deep is centrally located on the terrace. A second housepit was located by prior investigators about 30 meters north of the first housepit, but has been destroyed by the digging of a root cellar into the depression. This historic Euro-American root cellar has been designated 45DO191 (1978:126).

Whether one, two or three housepits were observed by our predecessors on these sites, we observed only one shallow (<50cm deep) basin-like depression on 45DO190 and the remains of a stone-lined root cellar on 45DO191. The third pit's location is a mystery.

Bryant (1978) placed a single 1x2m test pit each in the southwest rim of the 45DO190 housepit and in the root cellar floor. At 45DO190 he reported finding artifacts to a depth of 1.7m, but that all but three of the 21 artifacts (and apparently most flakes, bone, etc.) occurred within a 40cm thick band centered on 1.1m below surface. Artifacts included projectile point "preforms," hammerstones, quartzite knives, retouched flakes and objects of polished bone. Based on his reading of the stratigraphy and the vertical concentration of artifacts, Bryant concluded he had penetrated the housepit floor.

The test at 45DO191 cut through the root cellar's clay floor and revealed historic and prehistoric artifacts. Above the floor were nails, ceramics, and other metal debris but below it were bone fragments and fire broken rock characteristic of prehistoric midden deposits. Whether the cellar pit had once been an aboriginal habitation was not determined, but Bryant concluded, as we have, that 45DO190 and 45DO191 are parts of a once continuous site.

Technique.

Our approach to this site included a proton magnetometry survey, testing on a 10m grid and excavation of one small block (or trench) of three, contiguous 1m squares.

The magnetometer survey covered a 20x40m area of 45DO190 and revealed four large (Figure 190/191-1) and seven small anomalies. A and B are negative and resemble the anomalies caused by housepits at 45DO189 and 45OK207. The fact that Bryant's (1978) housepit corresponds with anomaly A supports his claim of having intersected a house floor. (Note: the anomaly appears to the north of Prolyst's test. This is a common phenomena with magnetometer surveys, which seem to show anomalies slightly to the north of actual cultural features [Robert Huggins, personal communication]).

We tested anomaly B, with results described below.

Eight 1x1m test pits were excavated into 45DO190 on a 10x10m grid; the six similar pits in 45DO191 were not so regularly placed because of the site's small area. Six additional 1x1m pits were placed in a sandy area of the erosion channel in hopes of finding undisturbed artifact deposits, without success. Vertical control was in all cases 20cm arbitrary levels.

Finally, a 1x3m trench was cut across the south edge of magnetic anomaly B to determine what sort of feature it might represent. Except for this trench, halted due to lack of time, all pits were taken down to fluvial gravels or, when depths became unsafe, only to coarse fluvial sands overlying the gravel. Maximum depth was just over 3m.

Physical Stratigraphy.

This site is stratigraphically simple. A base of river gravels (Stratum 5) is overlain by up to three layers of medium to coarse fluvial sand, then over 2m of fine-medium wind-reworked fluvial sand (Figures 190/191-2 and 190/191-3). Strata are described as follows, from bottom to top (Table 190/191-1).

Stratum 5. This is a level bed of unsorted gravels, cobbles and coarse sand deposited by the Columbia River when its bed was much higher than the historic level. This is time stratigraphic Unit X, river gravels of the T1 terrace level.

Strata 2, 3, 4. These are lower bar, channel bank deposits of time stratigraphic Unit XI. They are poorly sorted, finely bedded layers of medium and fine sand with clear boundaries. Color ranges from 10yr6/3 to 10yr7/3 (Munsell color). Mussel shell from the uppermost layer of this deposit (Stratum 2) was dated 4630+-110 BP (Beta 6263). Similar deposits at 45DO211 on the south end of Sanderson Creek Bar date somewhere between 3600 and 5500 BP (Lohse 1983, personal communication).

Stratum 1. These are gray-brown (10yr 6/3) fine to medium sands characteristic of wind-reworked upper bar fluvial sediments. The deposit is massive, the only breaks being two bands of organic material and artifacts found at varying depths. This is time stratigraphic Unit XIB.

At the downriver end of 45DO191, in pits along the 90N grid line (Figure 190/191-1) gravel of the Sanderson Creek Bar occurs less than 40cm below surface, 10m to the (grid) south the T1 fluvial gravels were not encountered even though our pits reached over 2m in depth (Figure 190/191-3). Thus it appears that T1 abuts an older bar deposit and in some areas, the upper-bar overbank sands of TS Unit XI unconformably

overlie the gravels of this bar.

Cultural Stratigraphy.

Using the vertical artifact distribution method combined with study of profiles, we have defined three occupations for this site.

Occupation I is centered at between 30 and 70cm below surface, where a distinct layer of organic material and/or shell, FCR and bone fragments can be seen in many profiles (e.g., Figures 190/191-2, 190/191-3).

Occupation I occurs in all test units, but its highest densities occur in the center of 45DO191 and on the south and upriver end of 45DO190 (Figure 190/191-4). There is apparently a housepit in Occupation I, in the 45DO190 area. The housepit (no. 1) corresponds to a large negative magnetic anomaly and has a dense artifact concentration 30-40cm above the predicted depth of Occupation II and nearly 1m below Occupation I (see features, below). Because of the depth of this occupation surface relative to the common depths of Occupations I and II and because of the "housepit" reading given by the magnetometer survey, we now believe this feature to be a housepit floor. The "housepit floor" reported by Bryant, although at the edge of a housepit-like magnetic signature, does not meet these same conditions. The depth of Occupation I artifact concentrations in nearby test pit 20N, 10W is identical to that observed by Bryant. There is no evidence whatsoever of a housepit in this area.

Occupation II occurs at 1-1.8m below surface in most areas. It is shallower in the downriver parts of the site (Figure 190/191-5), where the average depth is 1m, than in the upriver end, where a 1.4-1.6m depth is the rule. Again evidence of this occupation occurs throughout the site area, but artifacts are most dense in the southeast corners of both sites. A single housepit (2), its floor 1m below the Occupation II land surface in an area where no evidence exists of a third occupation beneath Occupation II, was found in the 45DO191 area. We originally reported (Management Plan Data Report) that HP1 was a living floor associated with the Occupation II surface, but now believe this conclusion to be false.

Occupation III is in Stratum 2, over 2m below surface. It is absent in 45DO191 and is best represented in the north and southwest corners of 45DO190 (Figure 190/191-6). Artifacts are in all cases sparse in this unit.

Chronology.

Table 190/191-2 presents the chronology of occupations at 45DO190/191 based on stratigraphy, projectile point chronology and radiocarbon dating. Justification for assignment of stratigraphic and projectile point dates and for acceptance or rejection of radiocarbon dates follows.

Stratigraphy. All three occupations are in sediments assigned to time ~~stratigraphic~~ Unit XI, which dates between 4700 and 2500 BP in the project area and elsewhere in the Columbia Plateau. Occupations I and II are in the upper bar alluvium and thus probably date to the latter half of this period. Occupation III's position in the low-bar fluvial sands places it toward the earlier end.

Artifact Chronology. The occupations can be easily placed chrono~~logically using th~~e over 30 projectile points and fragments as fossils directeurs. In Occupation I, small contracting-stemmed,

shouldered, triangular bladed points, often with serrated edges (Types 8 and 11) predominate (N=4); larger, square-stemmed points with excurvate, triangular blades and square to slightly barbed shoulders (Type 12) are secondary (N=1). Corner removed points are more abundant in Occupation II (N=5), although the contracting stemmed points are still the most common (N=7). Only two classifiable projectile points occurred in Occupation III, both of them with squared shoulders and a contracting stem with convex base (Types 8 and 11). All these Types (8, 11, 13) predominate in Period III (Lohse 1983), but also occur in Period II; Occupation I should date to 2500-3000 BP, Occupation II, 2500-3500 BP, and Occupation III 3000-4000 BP.

Radiocarbon Dating. We have obtained three radiocarbon dates from 45DO190/191: two from Occupation I and the third from Occupation III. One date from each occupation is from mussel shell, the remaining Occupation I date is charcoal from floor of House 1.

Dates are: Occupation III, shell, 4630+-110 BP (Beta 6263); Occupation I, shell 4590+-90 BP (Beta 6264); Occupation I, charcoal, 2500+-90 BP (Beta 5892). The Occupation I shell date is inconsistent with all other information, and will hereafter be ignored.

Artifacts.

Features. Features found in 45DO190/191 include two apparent housepits, and four hearths or hearth-like concentrations of burnt earth, FCR and/or bone. Concentrations of shell and fire broken rock were present in all occupations.

In no case did we uncover enough of a hearth or shell/FCR concentration to be able to discuss size or form; housepits, though, require discussion:

Housepit 1. This feature was found in 5S/0-3E (Figure 190/191-7). Placed to intersect the edge of negative magnetic anomaly A, a pithouse signature, our 1x3m trench located no walls, but a nearly level floor 120-140cm below surface. This floor was highly organic and had several large stones, clusters of fire broken rock, projectile points and evidence of at least two hearths (Figure 190/191-7). A few shells and large fragments of ungulate longbone were also present. In nearby test pits 0N/0W and 0N/10W, Occupation 1 centers on 40-60cm below surface; Occupation II is at 160-180cm and becomes progressively deeper up river.

Considering this feature's vertical position, the presence of large "furniture" rocks, repeated placement of hearths in an area that is near the center of magnetic anomaly A, large well preserved mammal bone fragments and numerous projectile points combine to make a strong case for identifying this as a housepit floor. Again, there appears to be but a single occupation layer in this 80-100cm deep housepit.

Use-Wear. There were 29 tools in Occupation I, 47 in Occupation II and 7 in Occupation III. In all three occupations, Class 16 is the most common usewear class. Class 19 second and Class 21 tertiary (Table 190/191-3). Class 1, 4, 14 and 15 are also present in Occupation I and II assemblages; Class 5 and 6 occur only in Occupation I.

Like 45DO189, the most often performed tasks employed light scraping tools, heavy cutting tools and projectile points in all three occupations.

Common Sense Tool Categories. The distribution of common sense tool classes, by occupation is as follows (see Table 190/191-3):

Occupation I: seven projectile points, two bifaces, two unifacially retouched flakes, two bifacially retouched flakes, one graver, eight tabular knives, one hammerstone, and one bone fish leister barb. Total, 24.

Occupation II: 14 projectile points, four bifaces, two unifacially retouched flakes, one bifacial retouched flake, two gravers, two scrapers, one spokeshave, six tabular knives, one pestle fragment, one anvil stone or hopper mortar base. Total, 34.

Occupation III: two projectile points, one uniface retouched flake, one graver and two tabular knives. Total, six.

Fauna. Deer and salmonids are predominant in Occupations I and II (Table 190/191-3); turtle and marmot are present in significant frequencies. Both assemblages are large (N=98 and 86 respectively). Occupation III contains only 12 identifiable elements, eight of which are fragments of turtle carapace (table 190/191-3).

There are several unusual features about the faunas in Occupations I and II. In combination with 45DO189 these are the only sites described in this report to include pronghorn (one element each) and with 45OK219, the only sites to contain beaver. In all cases, however, beaver is represented only by fragments of incisors that may have served as tools.

From an ecological standpoint, it is the endemic rodent fauna that is most interesting. Ground squirrel (N=7, MNI=4) and gopher (N=13, MNI=7) are both well represented, but their remains appear to be of different ages. Like the marmot, deer and salmon bones of the culturally introduced bone assemblage, ground squirrel elements are organically stained, whereas gopher bones are nearly white. Apparently, during the period of site occupation, ground squirrel was the principal fossorial rodent here, and was more recently replaced by gophers. One explanation for this change might be related to variations in soil moisture over time. Gophers are the true fossorial rodents, capable of tunneling through the earth even while it may be collapsing behind them. They move in their feeding tunnels by virtually swimming through the soil. For ground squirrels, tunnels and subsurface dens provide protection from predators and exposure. Collapsing soil would pose a threat to these animals, especially the young.

Today, the sandy soil of 45DO190/191, with its gravel substrate exposed by erosion, is loose and dry. If in the past, higher river levels and greater precipitation were the rule, the soil should have been more moist, firm and conducive to the maintenance of squirrel tunnels. We have already postulated on the basis of geologic evidence and the paleobotanical record that these conditions obtained. The change in 45DO190/191 rodent faunas is one more bit of evidence in favor of arguments for paleoenvironmental change.

Seasonality.

Seasonal data for all sites are inconclusive. Marmot (February/March to July) and painted turtle (February to November) are present in all occupations. But as we already pointed out, both species are equivocal indicators of seasonality. Marmot were smoked and stored; turtle shells may be curated for use as utensils. Aside from ethnographic analogy, which gives pithouse sites a winter/year-round period of occupancy (see discussion for 45DO189), there is but one other seasonal indicator at this locality.

A foetal deer was among the fauna in Occupation I. Both whitetail and mule deer bear their young in April and early May, so the site must have been inhabited at least during early spring. In Occupation II, on the floor of Housepit 2 we found the fully antlered calverium of a mule deer or blacktail deer (Odocoileus hemionus). Because antlers in this species are fully formed between October and March or April, Occupation II was at least a winter habitation. However, we cannot rule out the possibility that the calverium, too, was a curated item.

Lithic Material.

In terms of chipped stone, Occupations I and II are strongly similar to each other and 45DO189. In Occupation I (N=405), opal is 31% (N=127), jasper/chalcedony/petrified wood is 32.6% (N=132), and quartzite 33.6% (N=136). Basalt is present (N=6) and all other materials are rare. For Occupation II, opal comprises 30.7% (N=200), jasper/chalcedony/petrified wood 43.6% (N=284), and quartzite 23.5% (N=153). Again, other materials are rare.

Occupation III is distinct, both in age and lithic material content. Here, quartzite comprises nearly half the stone artifacts, 46.4% (N=32), with opal and jasper/chalcedony/petrified wood secondary at 24.6% (N=173) each.

Summary and Interpretation.

Three occupations occur in the Unit XI alluvium at 45DO190/191. Occupations I and II are pithouse sites probably occupied most intensively during the cold months, November through April. Light scraping tools, heavy cutting tools and projectile points were the main stone implements used there; deer, salmon, and to a lesser extent marmot and turtle were the principal animal foods. At the time these occupations were laid down, 2500 years ago for Occupation I, somewhat earlier for Occupation II, the site was an upper bar, subject to infrequent flooding.

People visited the site earlier, around 4500-4700 years ago when it was a low, annually flooded bar. While it is difficult to say exactly what the people who left Occupation III were doing, we can say this was not a pithouse site. The making and use of quartzite tools and consumption of turtles took place here, but we can say little else based on this site alone.

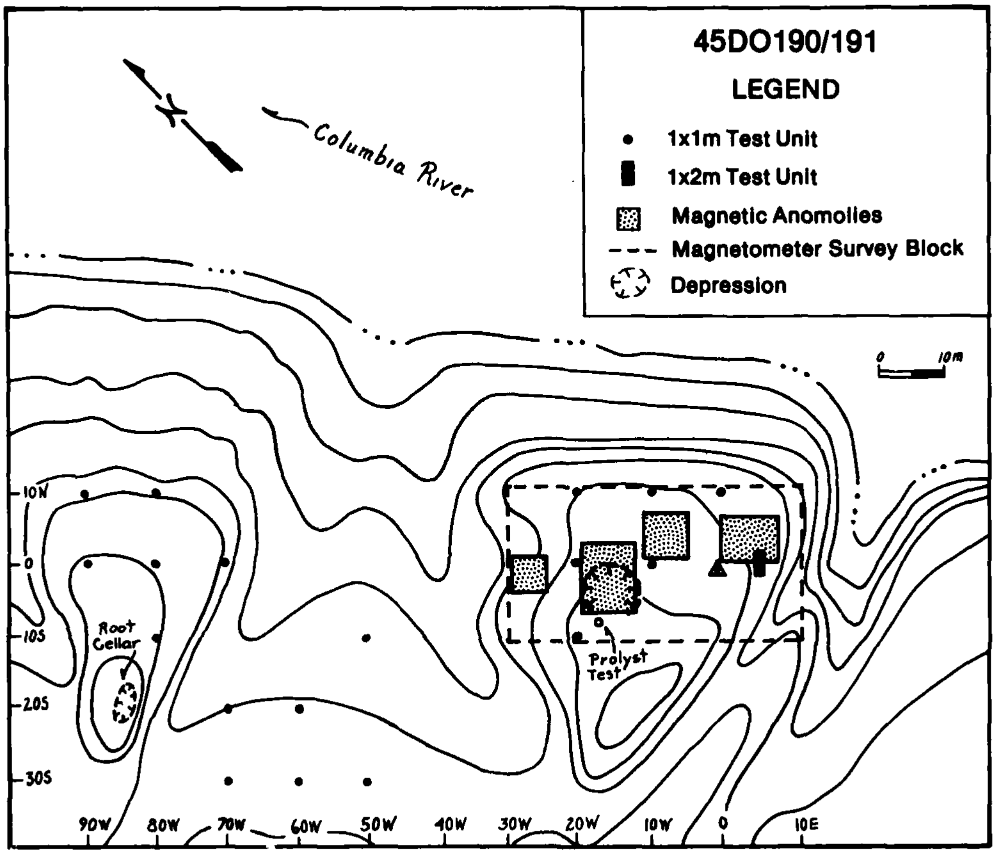


Figure 190/191-1. Map of site 45DO190/191, showing test pit locations and negative magnetic anomalies.

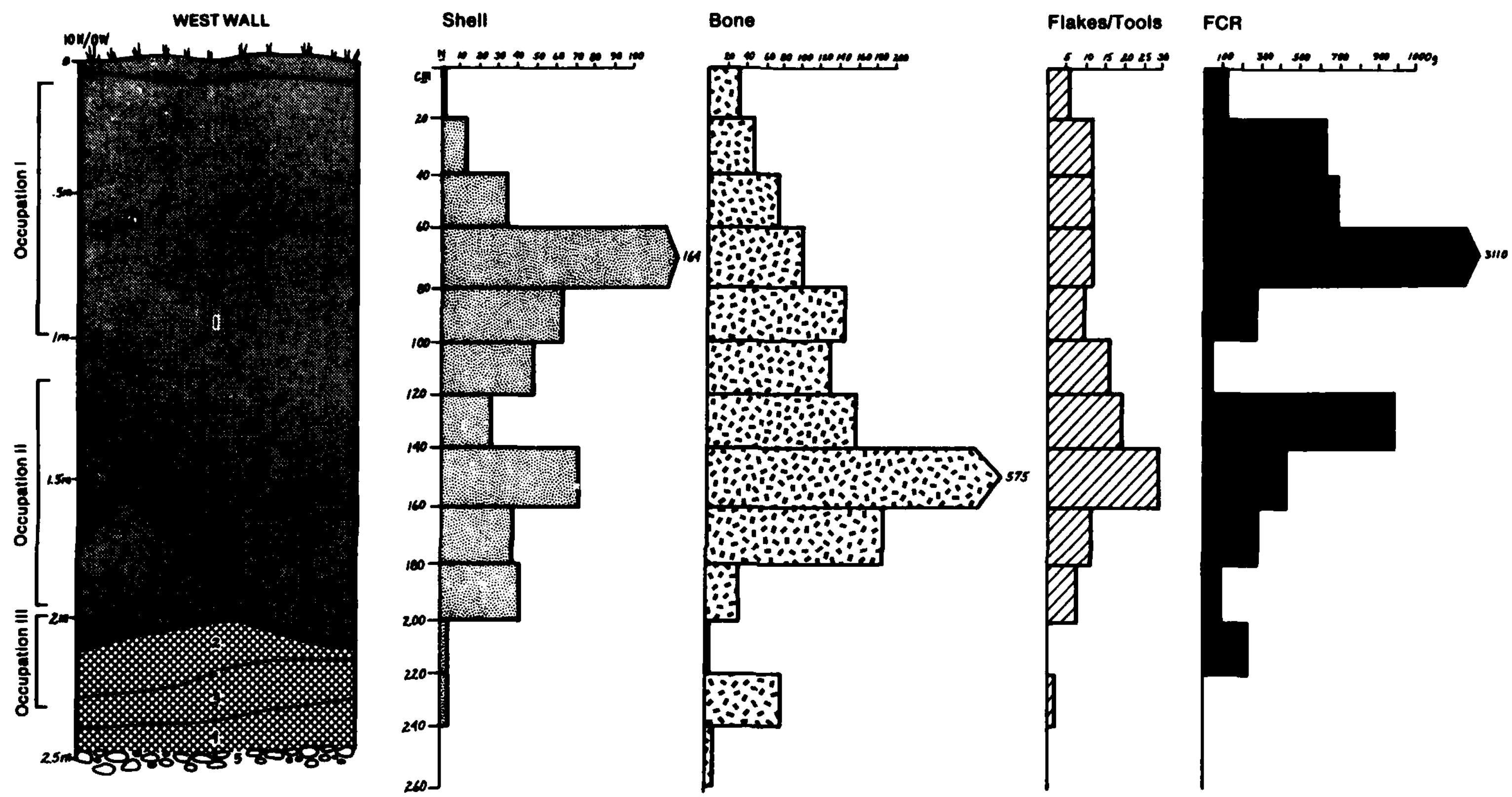


Figure 190/191-2. Profile of example unit in 45DO190, compared with artifact frequencies from the same unit. For legend, see Table 190/191-1.

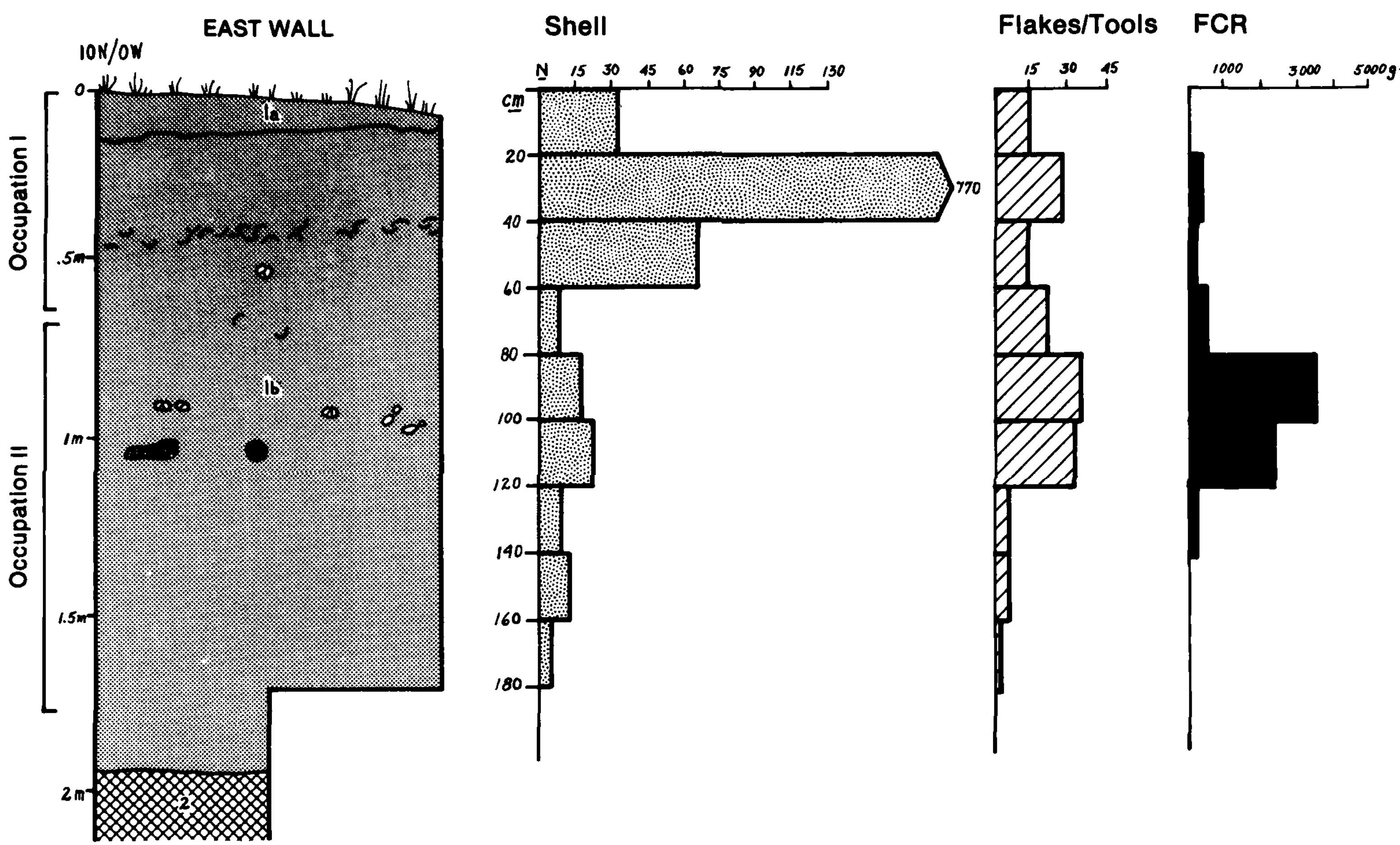


Figure 190/191-3. Profile of example unit in 45DO190, compared with frequencies from the same unit. For legend, see Table 190/191-1.

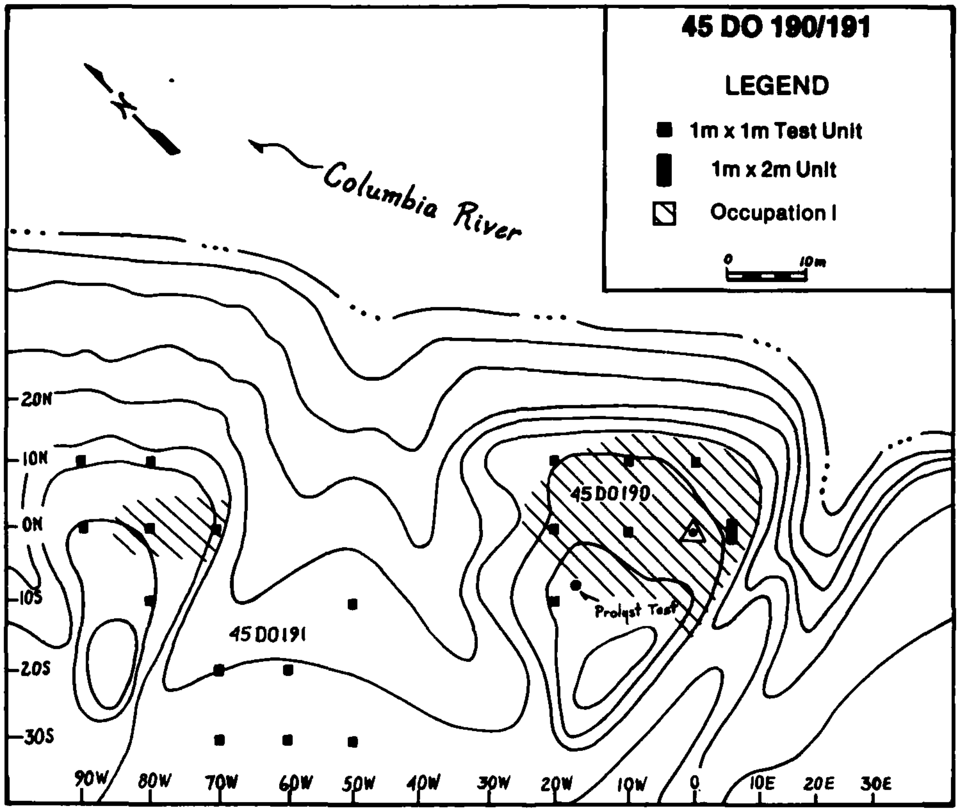


Figure 190/191-4. Areas of greatest artifact density in Occupation I, site 45DO190/191.

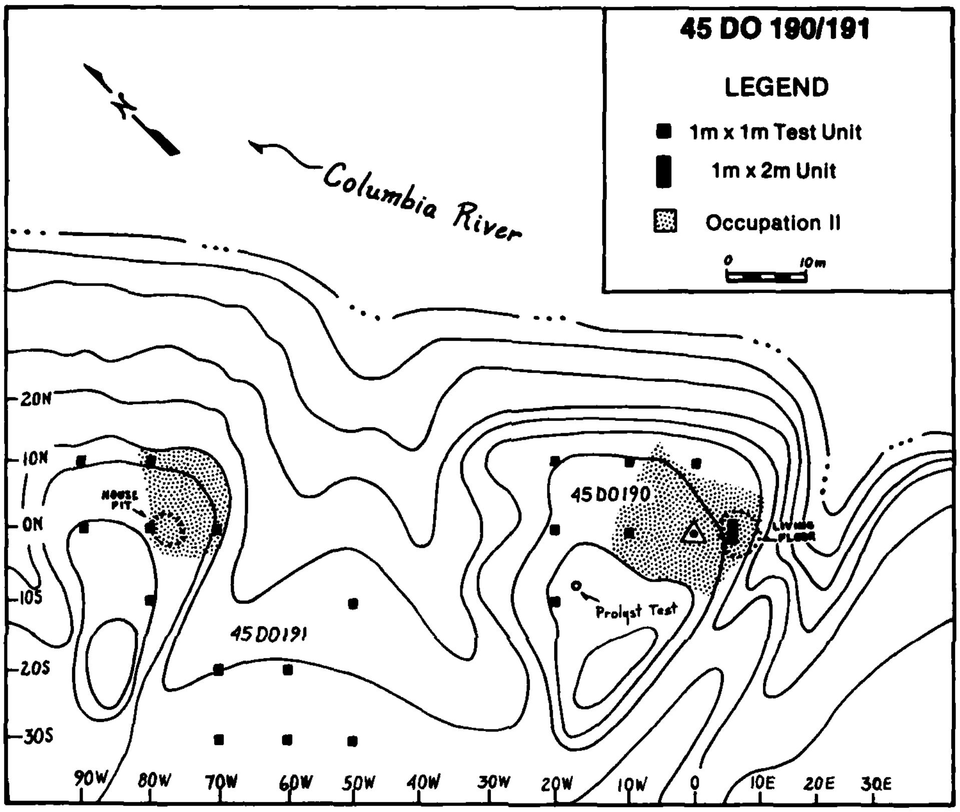


Figure 190/191-5. Areas of greatest artifact density in Occupation II. Site 45DO190/191.

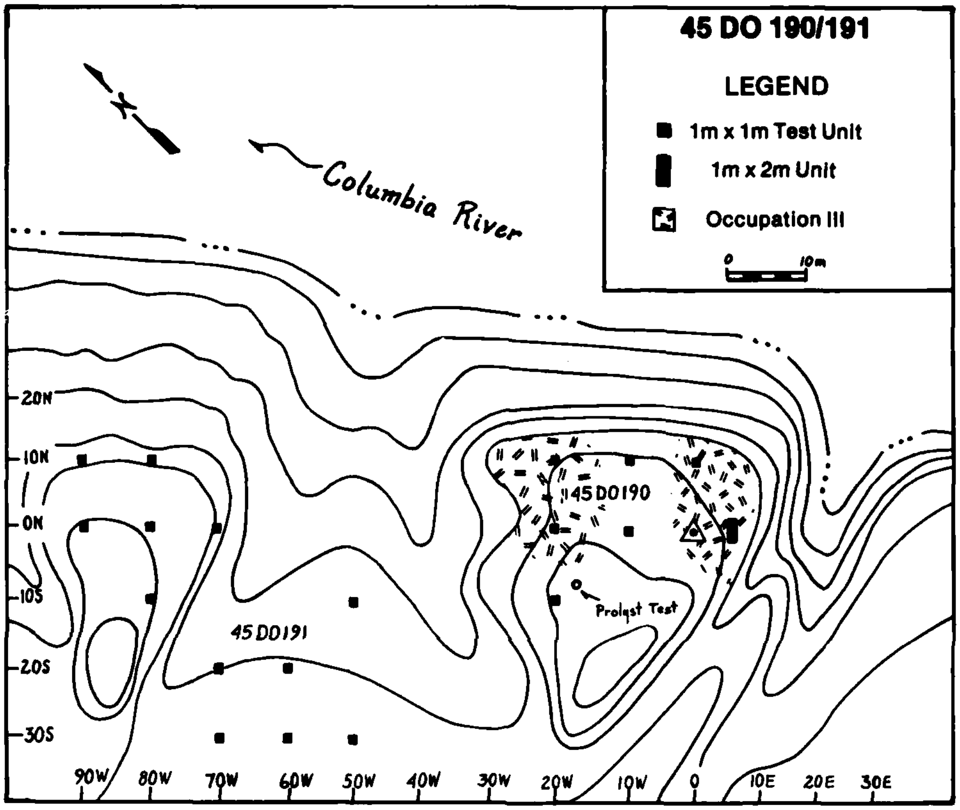


Figure 190/191-6. Areas of greatest artifact density in Occupation III. Site 45DO190/191.

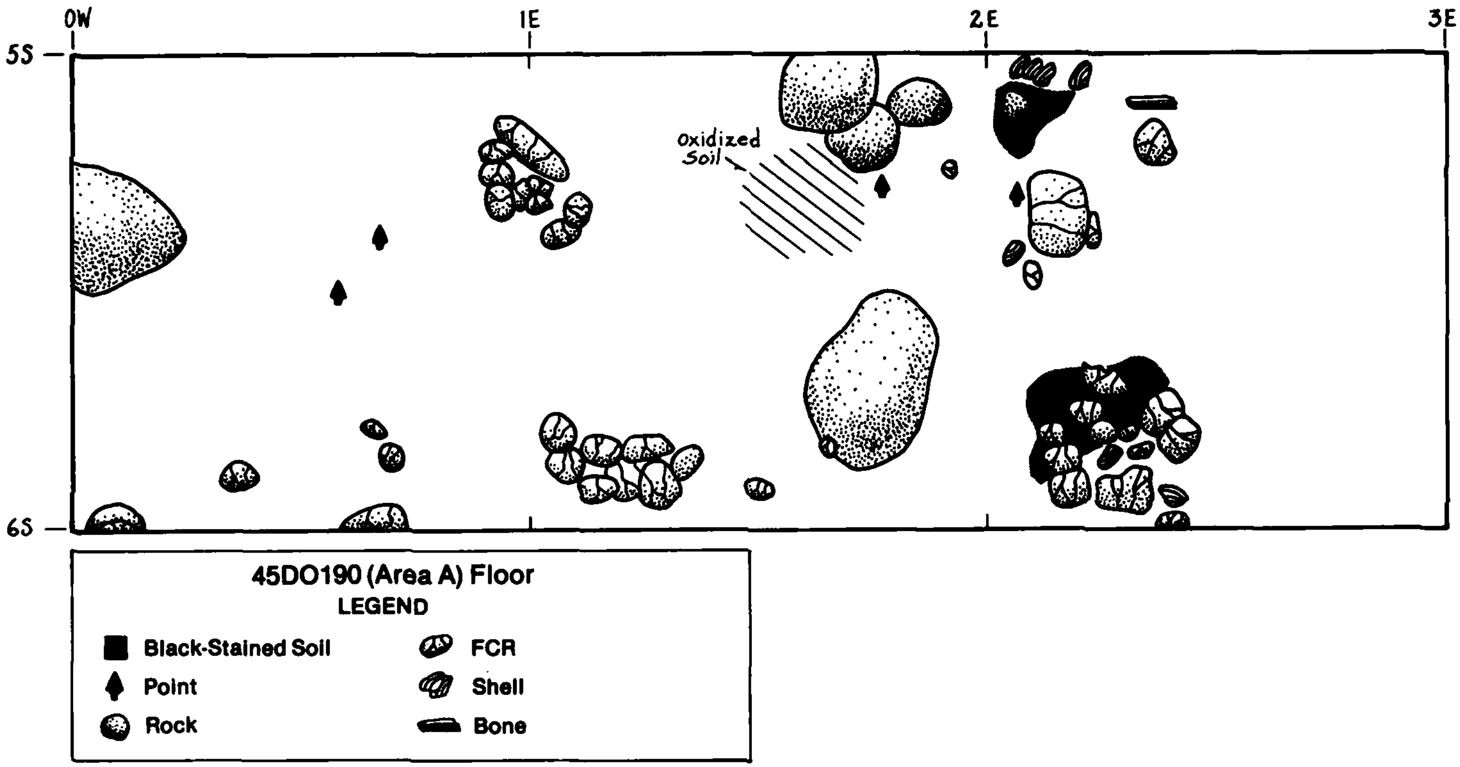


Figure 190/191-7. Plan map of artifacts and features encountered at the floor of House 1, 45DO190/191.

Table 190/191-1. Description of Geologic Strata of Site 45DO190/191

Stratum	Description
1.	Pale-brown fine sands. Slightly soft, massive with gradual, smooth boundary. Color: 10YR6/3. Occupations I and II occur in this stratum.
2., 3., 4.	Pale to gray-brown bedded fine to medium sands, fining upward. Slightly-soft to soft with abrupt boundaries. Color: 10YR6/3, 7/3. Occupation III is in Stratum 3.
5.	Rounded cobbles, coarse sand and gravel. Loose, boundary indeterminate.

TABLE 190/191-2.

SITE 45DO190/191

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume	11.0	7.8	4.8			1.2
TSU Position	Upper XIb	Mid XIb	XIa			
Radiocarbon Age	2500±90		4630±110			
Cultural Style Age	2500-3500	2500-3500	3000-4000			
Age Estimate	2400-2600	2800-3200	4300-4700			
FCR						
Count	1004	722	140			113
Weight (kg.)	67.5	73.3	12.0			14.8
Mean	.067	.101	.085			.130
Lithics						
Flakes	405	652	69			30
Common sense categories	20	27	52			6
Utilized flake/chunk	2	2	5			
Biface Ret. flake	2	1				
Amorph. fl. object	1	3	1			
Biface	2	4	4			
Projectile point	3	3	19			
Drill						
Graver	1	2	1			
Scraper		2	1			
Spokeshave		1				
Core		1	1			
Tabular knife	8	6	11			
Hammerstone	1		2			
Netsinker			1			
Chopper			2			
Anvil		1				
Punch			1			
Maul		1				
Projectile Point Types						
5	1	1				
6						
7		1				
8	3	5				
9						
10						
11	1	2	1			
12	1		1			
13		5				
14						
15						

SITE 45DO190/191

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class						
1	1	1				
2						
3	6	8	2			
4	2	2				
5	2					
6	1					
7	1					
8						
9						
10						
11						
12						
13						
14	1	2				
15	1	2				
16	7	18	3			
17						
18						
19	7	14	2			
Material						
Opal	127	200	17			
Jasper/chert, chalcedony	132	284	17			
Basalt	6	12	2			
Quartzite	136	153	32			
Other	4	3	1			
Features						
Hearth	1*	1	1			
Shell/FCR midden	2	1				
Pits						
Earth oven						
Housepit	1	1				
Form	Circular or Oval	?				
Diameter or L/W	?	?				
No. Floors	1					

*Located within housepit

SITE 45DO190/191

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains	2576	3140	276			104
Unidentified Bone	2420	2913	254			
Unburned						
ct.	2113	2333	136			
wt. (g.)	475.37	975.0	43.8			
Burned						
ct.	308	580	118			
wt. (g.)	204.7	338.0	37.8			
Identified Bone	156	227	22			
Unburned						
ct.	119	169	17			
wt. (g.)	112.17	226.88	17.3			
Burned						
ct.	37	58	5			
wt. (g.)	25.82	114.7	1.8			
Economic Fauna						
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis	2(1)		1(1)			
Odocoilcus sp.	38(3)	44(4)				
Cervus canadensis	2(1)					
Antilocapra americana	1(1)	1(1)				
Carnivora						
Canis spp.						
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris	13(2)	5(1)	1(1)			
Ondatra zibethica						
Castor canadensis	1(1)	2(1)				
Erethizon dorsatum			1(1)			
Reptilia						
Chrysemys p.	19(1)	13(1)	8(1)			
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45DO190/191

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae	10	7				
Cyprinid/ Catostomidae	2					
Aves	2	1				
Endemic Rodents						
Spermophilus	3(1)	3(2)	1(1)			
Microtus		1(1)				
Lagurus c.		1(1)				
Peromyscus	1(1)					
Perognathus						
Thomomys	4(1)	8(3)	1(1)			
Mollusca						
Margaritifera falcata		511	48			34

1. NISP (MNI)

45DO394

This site is on a tiny remnant of T1 Terrace, just downstream from Third South Draw at approximately 880m upstream from River Mile 590. It is on the south bank of the Columbia River in T30N, R31E, NE 1/4, NE 1/4, SW 1/4, Section 7. The surface ranges in elevation from 298 to 302m, m.s.l. (970-980') and extends 45m along the edge of a T2 escarpment at a maximum width of 15m (Figure 394-1). In pre-dam times, the river level was approximately 12-15m (40-50') below. Reservoir level is currently 5m (16') below the site surface. At its upstream end, the terrace is truncated by a deep ravine, the modern outlet of Third South Draw. Artifacts can be seen weathering from the 4m high cut bank and a few shells and flakes occur on the sloping terrace surface.

Previous Investigations.

Larry Fredin of Nespelem discovered this site, where he found part of a zoomorphic pestle, fire broken rock and mussel shell. In the spring of 1982, archaeologists from the Bureau of Reclamation and Seattle District, Corps of Engineers excavated one 1x1m test pit and two shovel tests in the terrace surface. They observed a 240+cm deep deposit of loose sand in which at least three distinct occupation zones could be discerned. These zones centered at 20-40cm, 100-120cm and 200-240cm in this test pit. Shell, bone, flakes and fire broken rock were observed, but no tools.

Techniques.

Investigations of 45DO394 entailed (1) inspection of the 4m high cut bank to determine the sites east-west extent, (2) excavation of four 1m wide bank facings from surface to cobble substrate, (3) excavation of four 1x2m test pits into the terrace surface (large test units were used here because the depth and looseness of aeolian sediment made smaller units extremely dangerous below 2m. Units were placed such that they provided inspection of most of the area from which bank observation appeared to contain occupation debris.), and (4) excavation of one 1x2m and one 2x2m area along the cut-bank, to expose and investigate deep occupations we might not have been able to reach safely from the other test pits.

Physical Stratigraphy.

Were it not for this site's proximity to the T2 terrace escarpment and the mouth of Third South Draw, its stratigraphy would be identical with that of 45DO190/191. Fluvial gravels and cobbles of Time Stratigraphic Unit X form the base, overlain by low-bar sands of Time Stratigraphic Unit XIA. Above this are over 3m of wind-reworked upper bar alluvium of the Unit XIB formation (Figures 394-2, 394-3).

Stratum by stratum, the deposits are described in Table 394-1. Stratum 11 comprises the river gravels of Unit X; Strata 5 through 10 are medium-to-coarse, low-bar fluvial sands and gravel. The gray-brown fine sands of Strata 1 and 3 appear to be a combination of wind-reworked overbank deposits and colluvial sand and silt from the escarpment above. In addition to these basic units there are numerous discontinuous bands and lenses of colluvial silt derived from Third South Draw and the eroding Nespelem Formation behind T2. As the contour map shows (Figure 394-1), the terrace elevation is lower at the upstream end. Colluvial silts are increasingly prevalent at lower elevations, until within 10m of the ravine, they make up over 80% of the deposit. Evidently, while the T1 was forming, water draining from Third Draw flowed onto the floodplain at the back (south) center of this now-remnant land form, flowed upriver along the T2 escarpment and thence to the Columbia. After the river and water table dropped toward modern levels, Third Draw

began cutting a new ravine upriver from the old drainage channel.

Only one layer of colluvium, actually a clastic flow representing a single erosional event, covers the entire site area. This is Stratum 2.

One of the most informative characteristics of this geologic deposit is Stratum 10 (Figure 394-2). Directly overlying the fluvial gravels, this stratum consists of poorly sorted, distinctly bedded sands that dip at an angle of 45 degrees toward the modern river channel. These are foreset beds, formed by a laterally migrating stream as it moved away from this site toward the opposite canyon wall. Foreset beds are the best evidence we have that the Columbia River had (1) a higher base level and (2) was meandering slightly (a very low frequency meander) during the formation of T1, 4700-2500 years ago.

These foreset beds and overlying low-bar deposits of Stratum 9 appear to have formed rapidly; the boundaries between beds are sharp, undeformed and free of any evidence for soil formation. The 3548+-90 BP (Beta 5893) date on cultural material found in the upper-most of these undeformed beds is, therefore, a close approximation for the beginnings of floodplain formation at this site. The top of upper bar deposits and end of floodplain formation here date shortly after 2700 BP (see Chronology, below).

Cultural Stratigraphy. Graphs of artifact frequency by level (Figure 394-3) show that occupation episodes were interrupted by substantial periods of non-occupation; five distinct frequency modes occur. These are occupations I through V (from the top). Stratigraphically they are situated as follows, with distributions.

Occupation I: upper Stratum 1
Occupation II: middle Stratum 3
Occupation III: middle Stratum 3
Occupation IV: uppermost graded bed - in Stratum 9
Occupation V: surface of Stratum 11 - a lag deposit

Artifact recovery was in all cases very low. All occupations appear to have been at least partially destroyed by erosion. The deeper one excavates, the less occupation area remains.

Chronology.

Figure 394-2 summarizes chronological information for the five components at 45DO394.

Artifact Chronology. There are only two projectile points from this site. These and a set of 20 slate beads comprise the total, temporally-diagnostic artifact inventory.

Both projectile points are members of Type 13, shouldered, expanding-stemmed points that Lohse (1983) refered to as Columbia River corner notched. These have an approximate temporal range of 2500-3500 BP. The beads, made from slate, are a 4mm diameter, 1mm thick disk variety that is common throughout the Plateau. Such beads have been found locally at various sites belonging to time periods II and III and thus, also date between 4000 and 2500 BP (Manfred Jaehnig, personal communication).

Radiocarbon. We obtained three radiocarbon dates from this site, two on charcoal and one on shell. Charcoal samples from Occupations I and IV, dated 2740+-70 BP (Beta 5891) and 3548+-90 BP (Beta 5893), respectively. These dates were consistent both with natural stratigraphy and artifact chronology. The third date, from Occupation II, returned a date of 4550+-90 BP (Beta 6262) and was inconsistent with all other chronological information. We have not used this third date

AD-A147 658 HUMAN ADAPTATION ALONG THE COLUMBIA RIVER 4700 - 1600 BP A REPORT OF TEST..(U) CENTRAL WASHINGTON UNIV ELLENSBURG GRADUATE STUDIES AND RESEA.. 3/4

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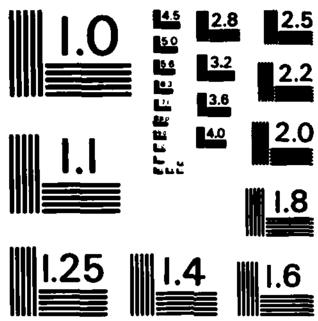

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

in our chronological analysis.

Function.

Because of the small quantity of artifacts recovered from all occupations at this site (Figure 394-2), placement of the five occupations into the local settlement system of Periods II and III is a shaky proposition, at best. After considering all information, however, we believe that a consistent pattern of site utilization can be discerned.

Features. Occupations I through IV (Figures 394-4 to 394-9) all contained at least one fire cracked rock and charcoal/burnt earth feature that can be called a hearth. Of these, all but III also had a shell and fire cracked rock midden either associated with the hearth or within 10m of it. There were no features observed in the 4 square meter exposure of Occupation V.

Use-Wear. Only nine stone tools were found in the entire site, as follows:

Occupation I:	one each of Classes 4, 5, 7, 19
Occupation II:	two of Class 16; one of Class 19
Occupation III:	one of Class 3
Occupation IV:	one of Class 19
Occupation V:	one of Class 4

The low frequency of tools is the only pattern we see here, but it too is important.

Common Sense Tool Categories. At 45DO394 there were:

Occupation I:	a projectile point fragment, one pestle (cut bank), an anvilstone and an awl.
Occupation II:	one projectile point and two tabular knives
Occupation III:	a scraper
Occupation IV:	one projectile point
Occupation V:	one utilized flake, 20 beads

Fauna. Identifiable vertebrate remains occurred only in Occupations I, II, IV and V (Figure 394-2). Endemic rodents and ungulates comprised the bulk of all assemblages except for Occupation V. Fish are conspicuously absent. Occupation V contains the most diverse assemblage, including mountain sheep, deer, muskrat and turtle.

When endemic rodents are removed from consideration, a consistent pattern can be seen among all upper occupations. Mountain sheep and deer occur to the near exclusion of all other taxa, with mountain sheep being the more common in Occupations I and IV, and in unusually high relative frequency in Occupation II.

In Occupation V, elements of turtle and muskrat are equal to the ungulates. This assemblage is like that observed in a similar geologic setting at 45DO190/191, Occupation III.

The high frequency of mountain sheep in all these assemblages is in marked contrast to the pithouse occupations of 45DO189, 45DO190/191 and all those on the river's north bank. It is, however, consistent with 45DO190/191 Occupation III, a non-pithouse occupation.

Lithic Material. Lithic assemblages are quite variable, probably an effect of sampling error (Figure 394-3). Only in Occupations I and V are there large enough numbers of items to permit even tenuous comparison with other site occupations. The two are very different:

Occupation I: Opal, 8.8% (N=3); jasper, etc., 85.3% (N=29) and quartzite, 5.9% (N=2).

Occupation V: Opal, 22.2% (N=8); jasper/chalcedony 33.3% (N=12); quartzite 30.6% (N=11); basalt 5.6% (N=2); other 8.3% (N=3).

Quartzite is the exclusive or predominant (over 80%) material in all other occupations.

Seasonality. The ungulate species found in this site are accessible, during all seasons, so is muskrat. However, marmots are active only in spring and summer, turtle only when the ground is not frozen. Therefore, at least Occupations V and II, containing turtle and marmot, respectively, represent a non-winter season.

Interpretation.

Occupation V seems to represent a temporary river-bank camp in the Period II settlement pattern. Judging from the presence of mountain sheep, muskrat and turtle in this occupation, it appears that the site's inhabitants were foraging opportunistically for their food. Their primary purpose at this site is unclear, but they may simply have camped here while en route elsewhere.

All other occupations at 45DO394 date to Period III (or very late II). In these occupations, ungulates, (usually sheep) predominate the faunal assemblage; hearths and thin shellfish middens occur. These, too appear to be temporary camps, but a focus on the hunting of ungulates, especially mountain sheep is evident.

In each case, the numbers of people visiting the site were probably small and their stays short.

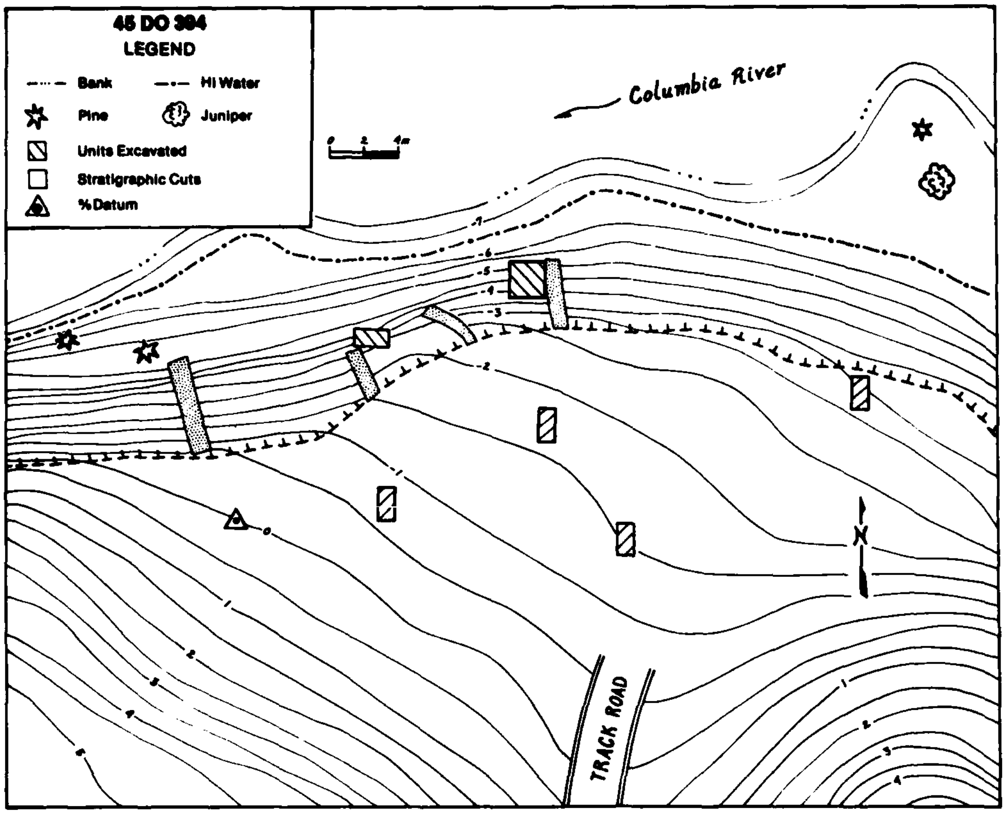

Figure 394-1. Map of 45DO394, showing the location of test pits. Contour interval .5m.

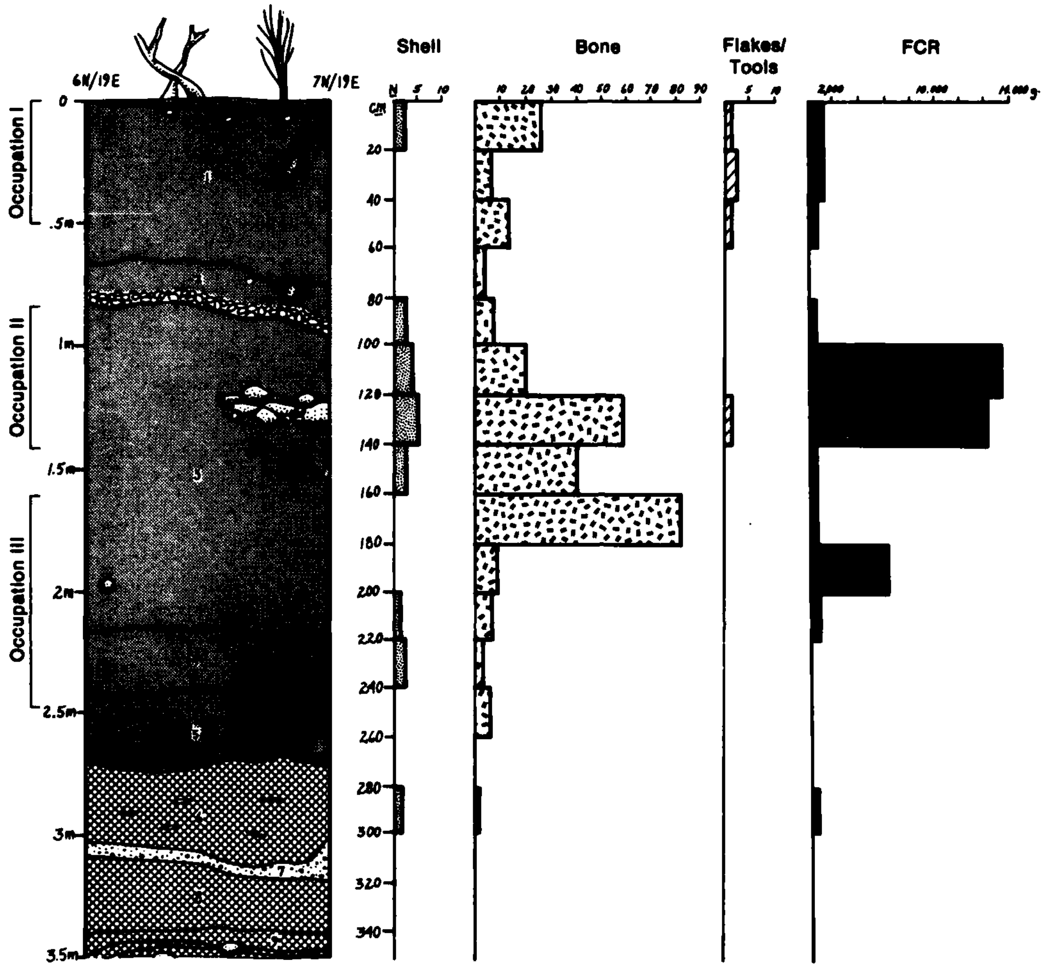

Figure 394-2. Example of profile from 45DO394, compared with artifact frequencies. See Table 394-1 for legend.

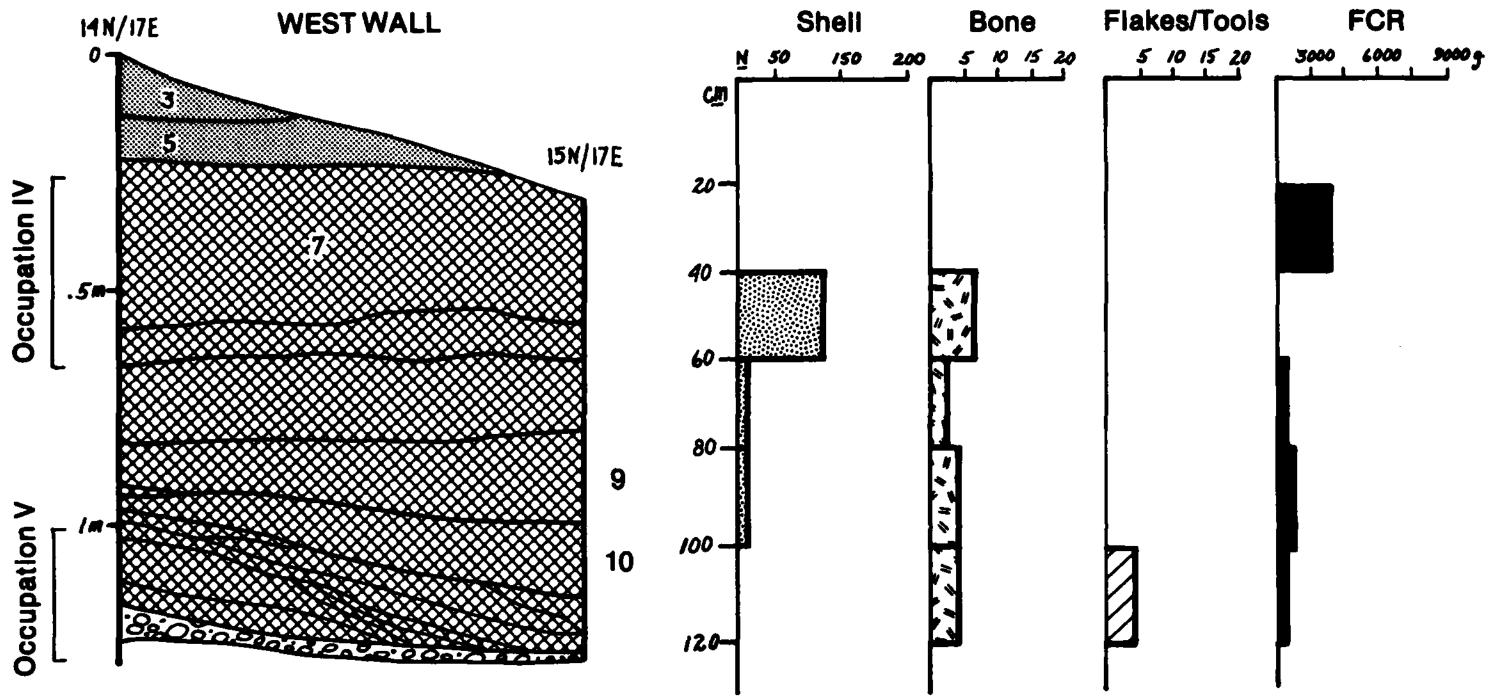

Figure 394-3. Example profile of deeper deposits at 45DO394, compared with artifact frequencies. See Table 394-1 for legend.

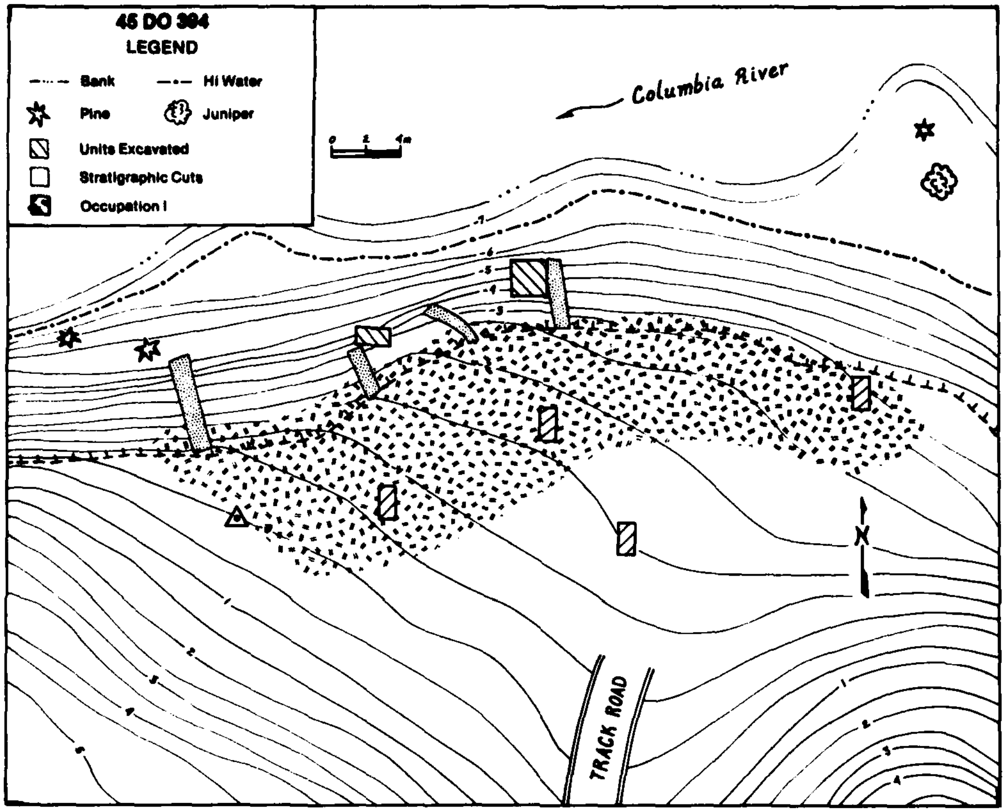

Figure 394-4. Areal extent of Occupation I, 45DO394.

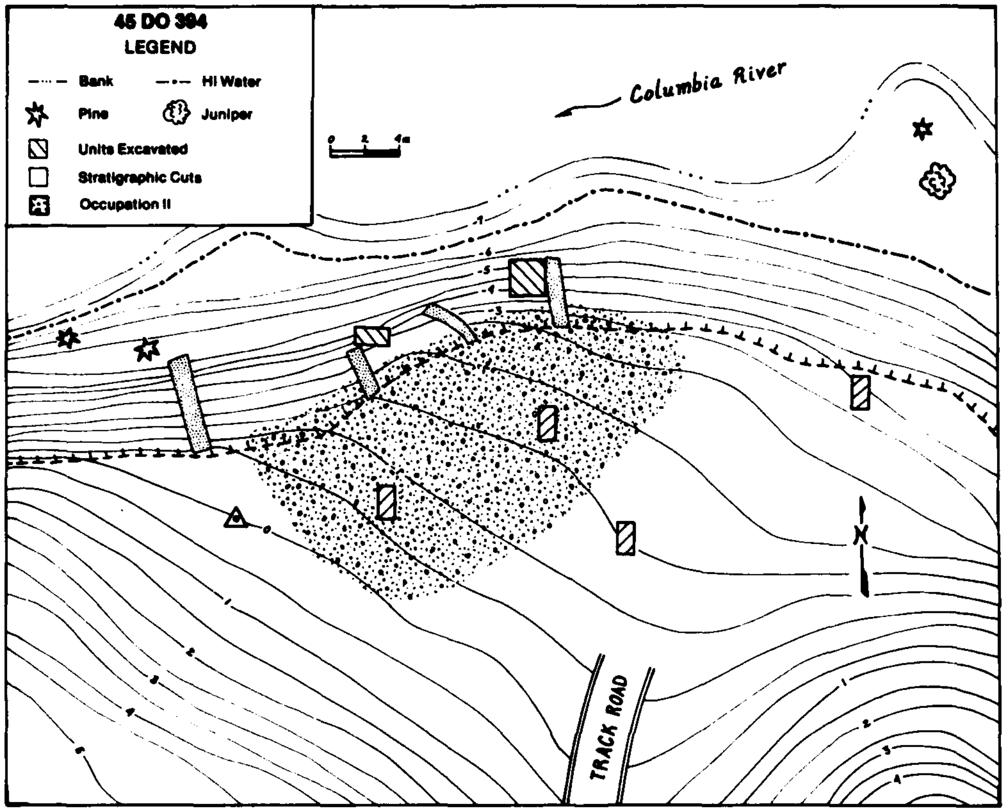

Figure 394-5. Areal extent of Occupation II, 45DO394.

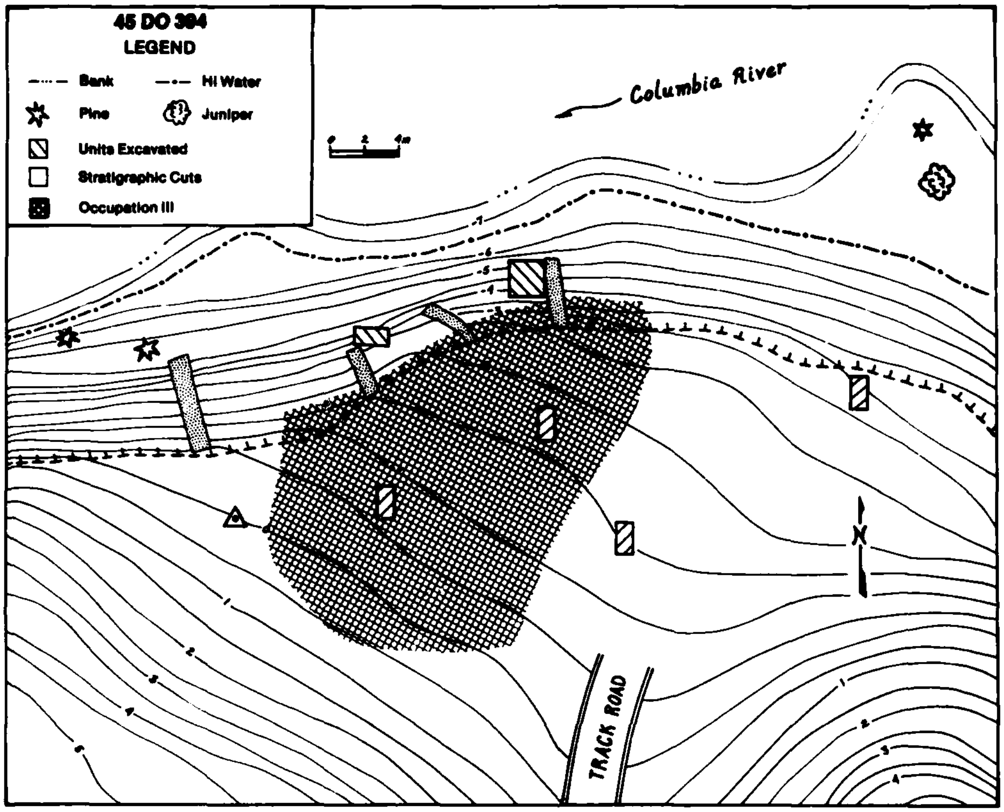

Figure 394-6. Extent of Occupation III, 45DO394.

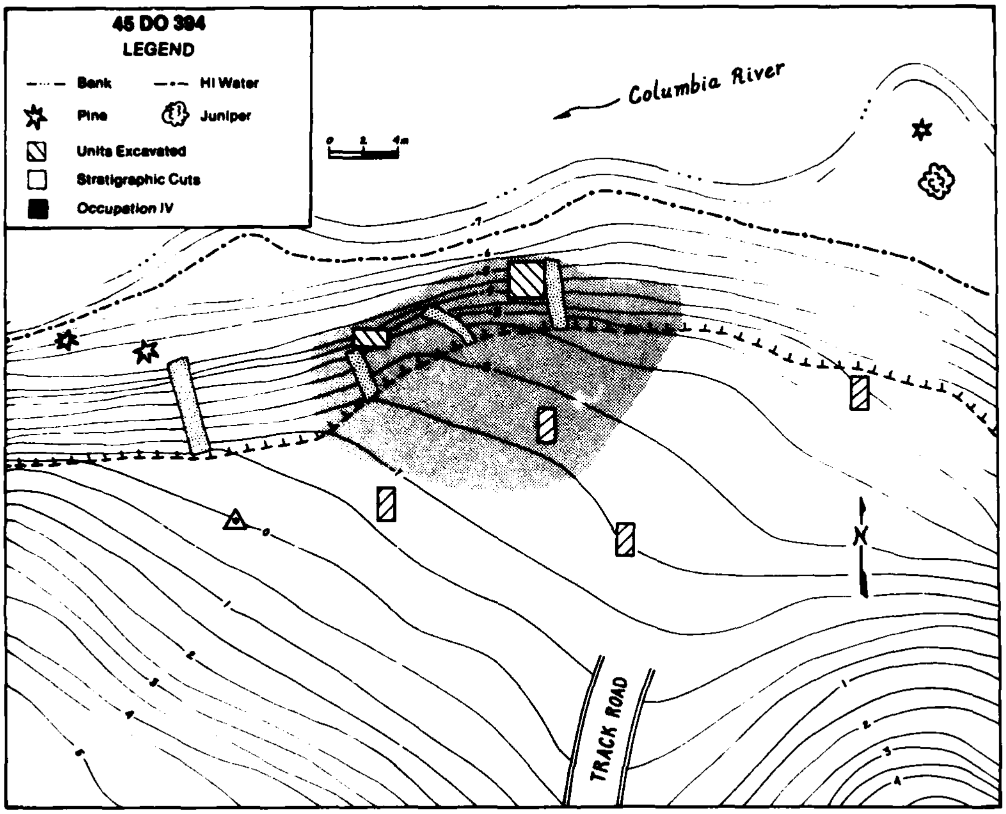

Figure 394-7. Extent of Occupation IV, 45DO394.

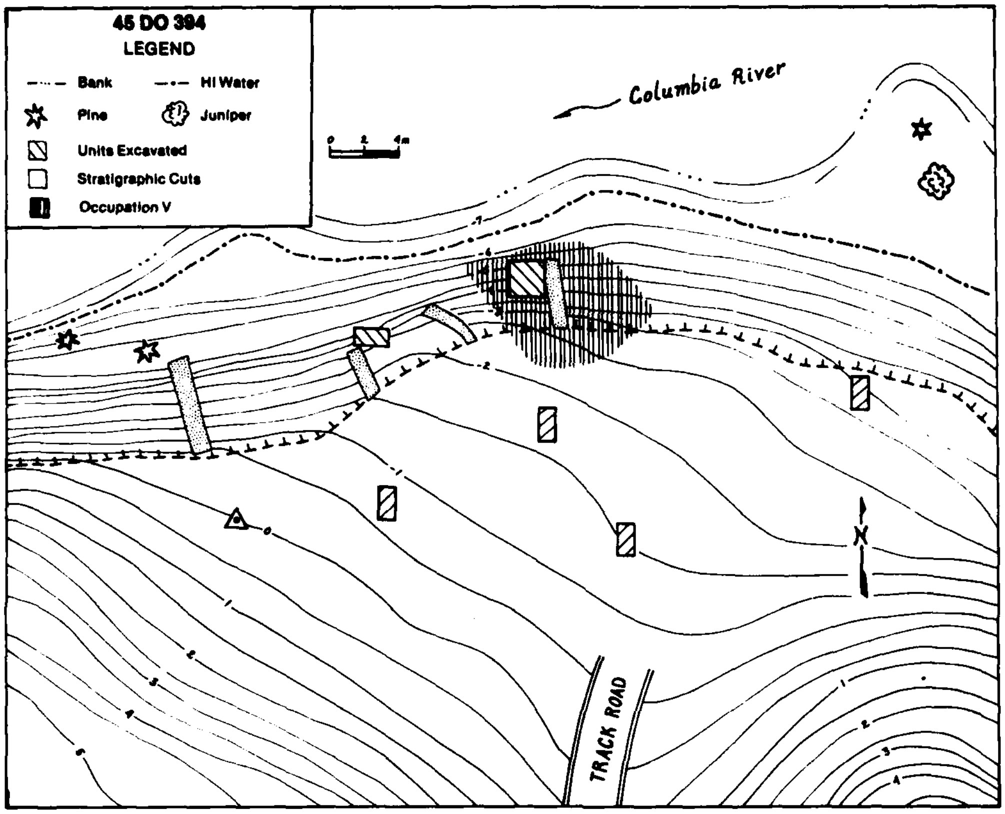

Figure 394-8. Extent of Occupation V, 45DO394.

Table 394-1. Description of Geologic Strata at Site 45DO394

Stratum	Description
1.	Brown loosely compacted silty fine sand. Massive with occasional lenses of silt, pea gravel and coarse sand. Soft, boundary abrupt and irregular. Color: 10YR5/2.
2.	Compacted pale-brown silts and rounded gravels. Compact, boundary abrupt and irregular. Color: 10YR6/3.
3.	Same as I, boundary clear and wavy. Contains Occupations II and III.
4.	Yellowish-brown, medium-fine sands slightly soft, boundary clear and wavy. Color: 2.5Y7/3.
5.	Pale-brown, loosely compacted medium sands, probably wind reworked. Soft, boundary clear and wavy. Color: 10YR6/2.
6.	Gray-brown fine to medium sand, aeolean, containing discontinuous lenses of tan silt. Soft, boundary clear, wavy. Color: 2.5Y7/3.
7.	Pea gravel in matrix of coarse sand, slightly indurated. Origin may be fluvial, boundary clear and smooth.
8.	Pale-brown fine sand, slightly soft. Boundary clear and smooth. Color: 10YR6/2.
9.	Sand, varying in size from medium to fine in distinct, horizontal beds. Loose with clear, smooth boundaries. Color varies from 2.5Y6/3 to 10YR6/2. Occupation IV occurs in the uppermost bed in this stratum.
10.	Finely bedded, poorly sorted sands, predominantly medium and coarse particle sizes. Beds are cross laminated, with laminae dipping northward, toward the present river channel. Thin lenses of magnetite are abundant. Source: fluvial; loosely compacted to loose, clear, smooth boundaries. Color: varies.
11.	Coarse sand and gravel. Loose, indeterminate boundaries. Occupation V appears at the surface of this stratum.

TABLE 394-2.

SITE 45DO394

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume	3.40	4.40	2.60	5.40	2.20	7.20
TSU Position	Upper XIc	Mid XIb	Mid XIb	Upper XIa	between X & low Xia	
Radiocarbon Age	2740±70	4550±90		3548±90		
Cultural Style Age	2500-3500	2500-3500	2500-3500	2500-3500	2500-3500	
Age Estimate	2650-2800	2800-3200	3000-3500	3450-3640	3500-3900	
FCR						
Count	80	95	38	37	6	7
Weight (kg.)	6.6	28.8	9.0	9.2	1.5	.360
Mean	.082	.303	.236	.248	.250	.051
Lithics						
Flakes	34	16	2	1	36	4
Common sense categories	3	3	2	2	7	2
Utilized flake/chunk	1			1	1	
Resharpening flake			1			
Projectile point		1			1	
Scraper			1			
Tabular knife		2				
Maul	1					
Anvil	1					
Bead					5	
Projectile Point Types						
5						
6						
7						
8						
9						
10						
11						
12						
13			1	1		
14						
15						

SITE 45DO394

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class						
1						
2						
3			1			
4	1				1	
5	1					
6						
7	1					
8						
9						
10						
11						
12						
13						
14						
15						
16		2				
17						
18						
19		1		1		
Material						
Opal	3	1			8	
Jasper/chert, chalcedony	29	5			13	
Basalt					2	
Quartzite	2	10	1	1	11	
Other			1		3	
Features						
Hearth		1	1	1		
Shell/FCR midden	1	1		1		
Pits						
Earth oven						
Housepit						
Form						
Diameter or L/W						
No. Floors						

SITE 45DO394

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains						
Unidentified Bone						
Unburned						
ct.	427	238	42	59	50	16
wt. (g.)	119.8	240.9	39.6	27.0	32.7	61.8
Burned						
ct.	81	102	21	3	5	5
wt. (g.)	26.0	33.1	6.8	1.0	0.7	0.8
Identified Bone						
Unburned						
ct.	9	18		1	6	
wt. (g.)	22.3	36.2		0.7	4.2	
Burned						
ct.						
wt. (g.)						
Economic Fauna						
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis	6(1)	3(1)		1(1)	2(1)	
Odocoilcus sp.	2(1)	9(1)			1(1)	
Cervus canadensis						
Antilocapra americana						
Carnivora						
Canis spp.						
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris						
Ondatra zibethica					1(1)	
Castor canadensis						
Erethizon dorsatum						
Reptilia						
Chrysemys p.						
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45DO394

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae					2	
Cyprinid/ Catostomidae						
Aves						
Endemic Rodents						
Spermophilus						
Microtus						
Lagurus c.	1(1)					
Peromyscus						
Perognathus						
Thomomys		6(2)				
Mollusca						
Margaritifera falcata	12	278	21	438	3	54

1. NISP (MNI)

45DO12M

This site is at the intersection of a strip of modern floodplain with the alluvial fan from Second Draw, just a few hundred meters upriver from Sanderson Creek Bar, 240m above River Mile 590. The legal description is T29N/R31E, SE 1/4, SW 1/4, NE 1/4 of Section 7 (W.M.). Surface elevation is 294-296m, m.s.l. (955-960') at approximately 8.5m (27') above pre-dam river levels. It is in a combination of riparian brush and steppe vegetation. There was no surface evidence of human occupancy at this locale when we began our investigations.

Previous Investigations.

The site was reported by Leeds, et al.(1980). The site is on U.S. Bureau of Reclamation property.

Techniques.

Two 1x1m test units were placed in the site spaced 10m apart and 7-10m from the water's edge. One test pit cut into the edge of Second Draw's alluvial fan, the other into floodplain deposits. The fan unit ended on cobbles at 1.2m, the other unit at 2.2m below surface.

Occupations.

Each pit contained one or two cryptocrystalline flakes and a few bits of bone (Table 12M-1) in nearly every level, with no noteable concentrations and no evidence of vertical stratification, except that massive upper bar sand overlay cobbles in both cases. No discrete occupation is evident and no dateable material was recovered.

Interpretation.

Human activity at 45DO12M was intermittent, short-lived and/or probably was centered to the north of the terrace remnant on which this site was identified.

TABLE 12M-2.

SITE 45DO12M

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume						240
TSU Position						X
Radiocarbon Age						
Cultural Style Age						
Age Estimate						
FCR						
Count						20
Weight (kg.)						4.3
Mean						2.15
Lithics						
Flakes						18
Common sense categories						0
Projectile Point Types						0
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

SITE 45DO12M

SUMMARY OF CONTENTS

Category	OCCUPATION I	II	III	IV	V	Unassigned
Lithics						0
Use Wear Class						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
Material						
Opal						
Jasper/chert, chalcedony						
Basalt						
Quartzite						
Other						
Features						0
Hearth						
Shell/FCR midden						
Pits						
Earth oven						
Housepit						
Form						
Diameter or L/W						
No. Floors						

SITE 45DO12M

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains						
Unidentified Bone						36
Unburned						
ct.						
wt. (g.)						
Burned						
ct.						
wt. (g.)						
Identified Bone						
Unburned						
ct.						
wt. (g.)						
Burned						
ct.						
wt. (g.)						
Economic Fauna						
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis						
Odocoilcus sp.						
Cervus canadensis						
Antilocapra americana						
Carnivora						
Canis spp.						
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris						
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatun						
Reptilia						
Chrysemys p.						
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45DO12M

SUMMARY OF CONTENTS

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae						
Cyprinid/ Catostomidae						
Aves						
Endemic Rodents						
Spermophilus						
Microtus						
Lagurus c.						
Peromyscus						
Perognathus						
Thomomys						
Mollusca						
Margaritifera falcata						

1. NISP (MNI)

45OK165

This is a long, narrow site spread across the T3 terrce just above and downstream from Orchard Creek (Figure 165-1). Located in T29N/R30E, NE 1/4, SE 1/4, SE 1/4 of Section 1, the site is at a mean elevation of 328m, m.s.l. (1065') approximately 41.5m (135') above the pre-dam river level.

The land surface includes a long, parabolic sand dune or dune remnant parallel with the escarpment behind T3. According to Barney Owsley, who has owned the adjacent property for over 40 years, this was formerly the site of buildings associated with the Steveson (or Barry) ferry. The ferry was operated between the Townsite of Barry, on Sanderson Creek Bar, and this location between the 1890s and 1930s. The historic buildings at 45OK165 were the ferry's north station and were occupied by the daughter and son-in-law of Steveson, who ran the ferry. Today four root cellar depressions and a shallow house foundation pit (all excavated on the dune crest) and associated trash are all that remain of this establishment.

An earlier, prehistoric component can be seen eroding from the T3 edge for the entire length of the site. One large, shallow depression can be seen near the terrace's outer edge, where a 40cm thick, organic-rich band can be seen in the cut bank.

Previous Investigations.

This site was originally part of 45OK69 recorded by Osborne in 1949, which encompassed all site areas along the surface of T3 in the Orchard Creek vicinity. In 1970, Leonhardy renamed the prehistoric portion on the downriver side of the stream 45OK165 and the historic portion 45OK173 (see also Lyman, 1975). Bryant (1978) later reported on the site, but was unable to investigate it. All authors suggest that this may be the semipermanent settlement named Salqua 'xuwi'x by Ray's (1936) informant. This name, meaning "where the trail meets the river" is more properly assigned to the extensive housepit site of 45OK6, now under water.

Techniques. We placed our excavation datum on the dune ridge and superimposed a 15m grid parallel with the dune crest (Figure 165-1). The eight 1x1m and seven 50x50cm test pits excavated in this area (Area A) were needed to define all horizontal dimensions of the prehistoric component, but nearer the river, in the power pole area (designated Area B), natural exposures gave us all site limits except the back or upslope boundary. To obtain this, we extended a line of four 1x1m of pits from our baseline down to the terrace edge along the 105 west line. Figure 165-2 shows distributions of artifacts obtained from our test excavations.

Physical Stratigraphy.

Site 45OK165 is the most geologically complex site in our study area. Areas A and B have almost totally distinct stratigraphies. Area A consists of alluvial and aeolian sands lying unconformably on the Nespelem Formation. Area B is primarily colluvial and includes Columbia River gravels. Figure 165-3 is a schematic profile crossdating Areas A and B. Stratigraphic descriptions are presented in Table 165-1.

Stratum 10 is bedded tan silts of the Nespelem formation unconformably overlain in Area A by coarse, lower bar fluvial sands interbedded with colluvial flows of reworked Nespelem silt (Stratum 8). In Area B, Stratum 9, Columbia River gravels overlie a silt substrata and corresponds in age with Stratum 8. Strata 10, 9 and 8 represent time stratigraphic Units I, II and IIIB/IIIC (combined).

Unconformably on the Columbia River gravels (9) and conformably on the lower bar sands lies Stratum 6, a yellow brown silty fine sand that resembles wind-reworked alluvial deposits (Time Stratigraphic Unit VI). None of the strata already mentioned contains Mazama ash, so all predate 6700 BP.

The surface of Stratum 6 has been subject to extensive erosion and is unconformably overlain by nearly pure Mazama tephra (Stratum 7) in Area A (see Appendix D, Volcanic Ash Studies) and tephra-rich colluvium in Area B (Stratum 5). Strata 5 and 7 are of widely disparate ages, 2270+-50 BP and 6700 BP, respectively, so the unconformity in Area B clearly represents a greater gap in our stratigraphic record.

In Area A this gap is filled, at least partly by an ash and organic material-rich stratum, a buried A horizon. This buried soil corresponds to Soil 1 in the time stratigraphic sequence.

Artifacts are found at the surface of this soil in Area A and in Strata 3 and 5 in Area B. It appears that the event creating Strata 3 and 5 took place after the soil formation period, removing tephra and sand from upslope in the A area and redepositing them below. This event occured for a period following 2200 BP, when human occupancy began in Area B and colluvium deposition in that area continues today. Sometime during the past 2200 years, a deep dune formed in Area A.

Cultural Stratigraphy. We are able to discern only one occupation at this site, which has been interrupted by frequent slope-wash episodes but is otherwise representative of a continuous period of frequent occupancy. This occupation includes several hearth features (4), at least two mussel shell and fire broken rock middens (one in each area) and at least one large housepit. There are three distinct occupation areas, one in Area B and two in A; only in Area B is the density of cultural material very great (Figure 4C). All identifiable bone (except endemic rodents) and most tools came from Area B, so conclusions drawn about site chronology and site function apply largely to that area.

Chronology.

Physical Stratigraphy. Using stratigraphy alone, we were only able to determine that 45OK165 was occupied after 6700 BP and before the historic period.

Artifact chronology. Three projectile points were found, two in Area B and one in Area A. Area B points belong to Types 11C, and 15A. The other specimen is a representative of 12C. Assuming all these artifacts were deposited about the same time, 45OK165 should date between 2500 and 2000 BP.

Radiocarbon. A single charcoal date was obtained from the bottom of Stratum 5: In Unit 22.5n/105w. Its date of 2270+-50 BP (Beta 5256) is consistent with both other means for dating the site.

Artifacts.

Features. Four fire broken rock and charcoal concentrations (three in Area A, one in Area B), two rock and shell features (one in each area), an apparent housepit and one small pit (both in B) were found at 45OK165. As usual the hearths were only partially exposed and, unfortunately for our dating efforts, charcoal was sparse.

House 1. The house floor was indicated by an abundance of tiny FCR and bone fragments, 1.3-1.4m below the surface in the center of the large (ca. 7-10m wide) circular depression already mentioned. Cultural material in other site areas was

no deeper than 60-80cm., in the absence of such a depression. Because of this disparity between depthes of cultural material, we believe this feature to be a housepit. We did not intersect the house wall, so construction details are unknown. However, based on the depth of deepest floor deposits below the common elevation of occupation, the house was probably 80-100cm deep when originally constructed. This deepest floor level consisted of black, charcoal-rich sand. Twenty centimeters above this floor and separated from it by a single layer of colluvial sand, was a second apparent floor, consisting of FCR and fine ash. Thirty centimeters above that was another rock layer, with a hearth feature included. The Type 15 projectile point came from this third possible floor level. Because of the continuous organic fill and three apparent floor levels, this house appears to have been in nearly continuous use for many years.

Use-Wear. Only 17 tools were recovered from 45OK165 (Table 165-2). Projectile points are most common (4 fragments); Class 3 and 16 (light scraping, heavy cutting) are represented by three tools each. Class 7 (hammerstone) is the only other tool with more than one representative (N=2). This assemblage is similar to Occupations I and II at 45DO190/191 and Occupation I at 45DO189.

Common Sense Tool Categories. In an assemblage of 22 objects, there are 4 projectile points, 4 biface fragments, 6 utilized flakes, 1 scraper, 3 tabular knives, 1 hammerstone, and 2 choppers (Table 165-2).

Fauna. This site is very similar to 45DO190/191 Occupations I and II. There were 53 identified elements at this site (Table 165-2). After endemic rodents (ground squirrel, N=2, vole, N=2) are removed, deer comprise 45% (N=22) of identified specimens in the assemblage with salmonids, 24% (N=12) and turtle, 16% (N=8). Marmot, mountain sheep, elk and bird are represented by only one or two elements each (5% or less).

Seasonality. As before with so many of our sites, only ethnographic analogy can be used to determine seasonality (see description, 45DO189, above). This is another winter/base camp by that reasoning.

Lithic Material. Opal and jasper/chalcedony, and petrified wood were the most common lithic materials (31%, N=100 and 51%, N=165, respectively). The remainder included 9% basalt (N=29), 6.5% quartzite (N=21) and 2.2% (N=7) other materials (Table 165-2). Another 183 flakes were indeterminate, having been too heavily charred for recognition.

Interpretation.

45OK165 is a single occupation, Period IV housepit site. The single housepit was used repeatedly throughout the occupation (at least 3 floors can be discerned). It probably was a winter base camp and, like ethnographically-reported base camps, may have been partially occupied throughout the year.

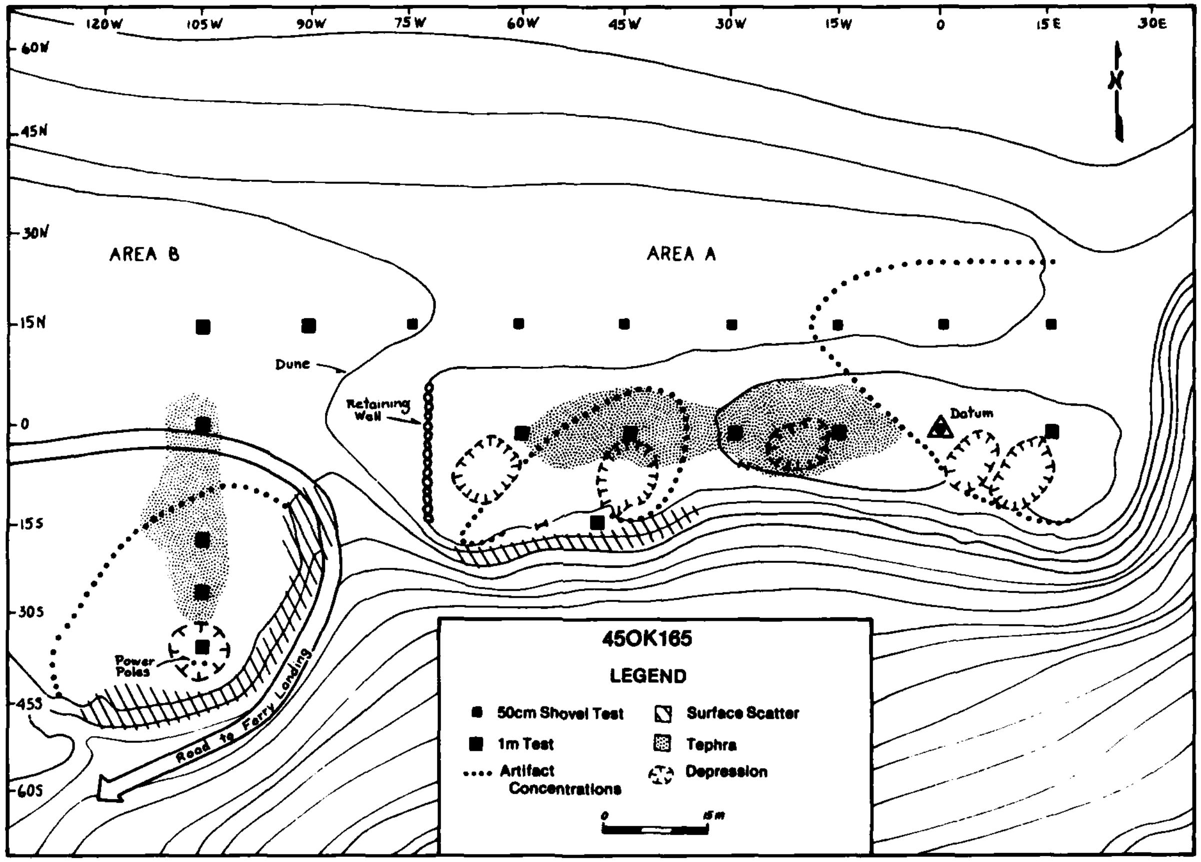

Figure 165-1. Sketch map of site 450K165, showing the known site boundaries (dotted lines), distribution of Tephra and modern surface features.

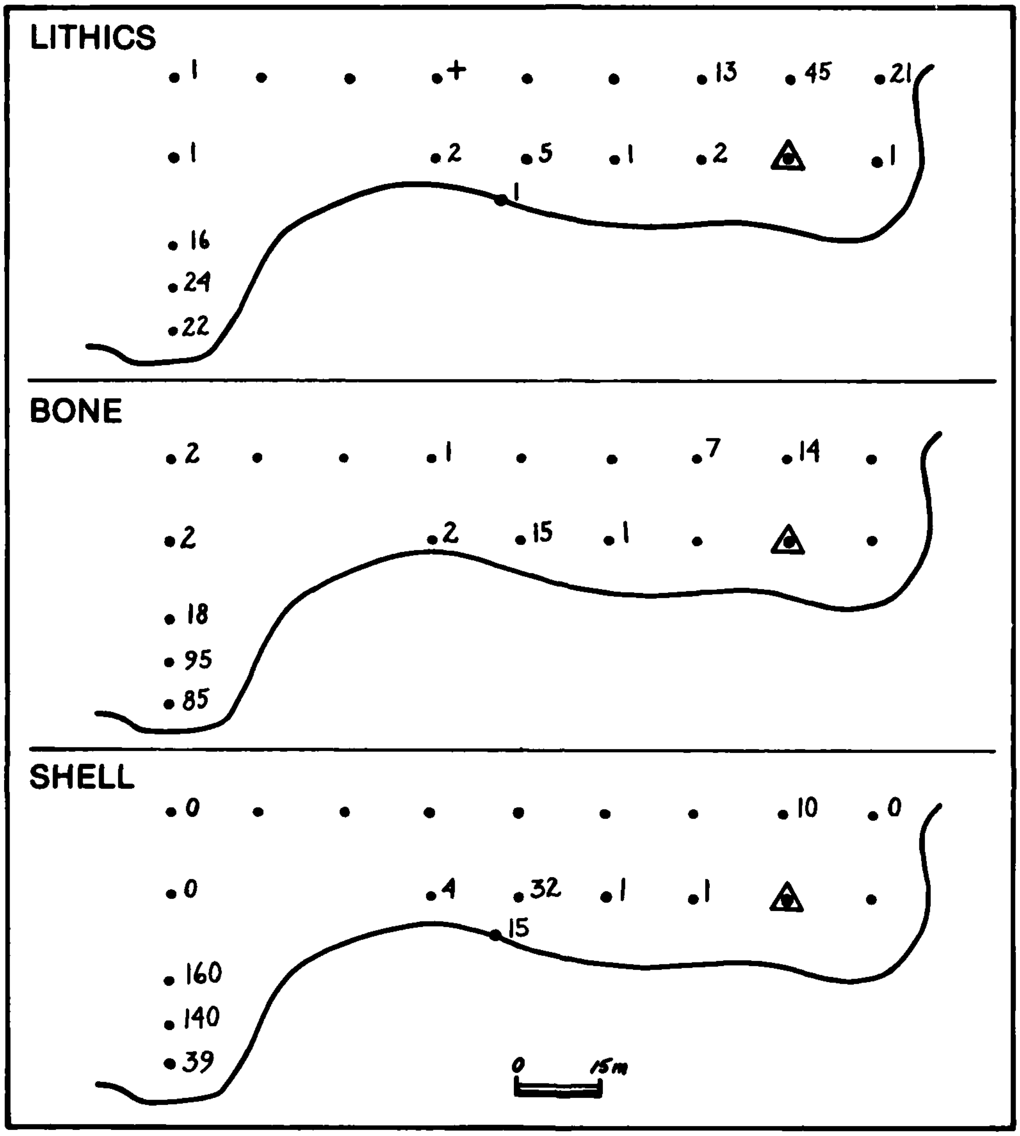

Figure 165-2. Plan view of site 45OK165, showing artifact distributions. Numbers are artifacts per 50x50cm square.

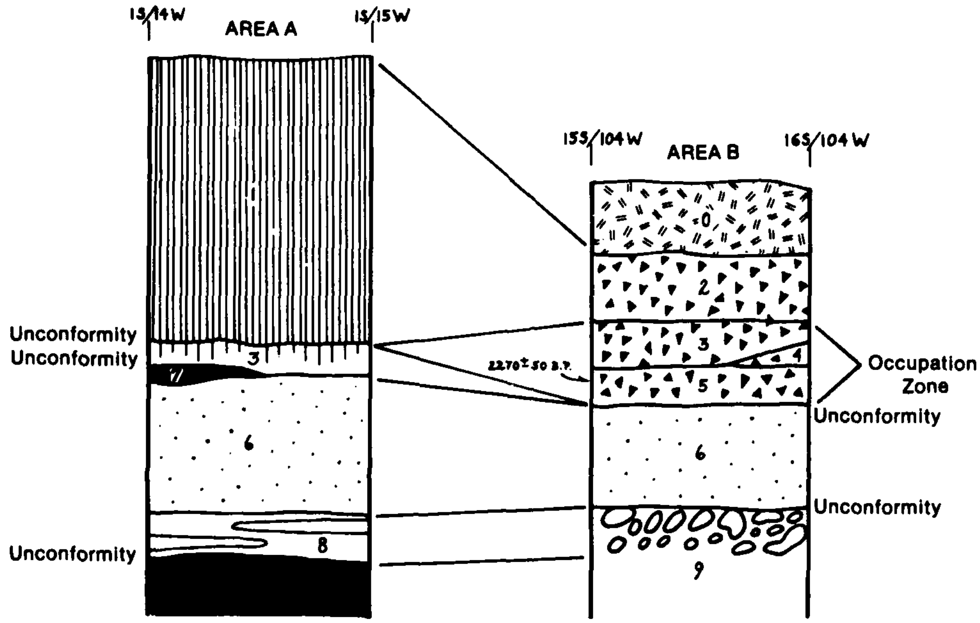

Figure 165-3. Cross-dated schematic profiles from 45OK165. See Table 165-1 for legend.

Table 165-1. Description of Geologic Strata at Site 45OK165.

Stratum	Description
0.	Vari-colored, laminated and lensed fine sands and silts (historic colluvium). Slightly soft, boundary clear and wavy.
1.	Light gray-brown fine sands, massive, slightly loose to soft, boundary clear and smooth. Color: 10YR7/3.
2.	Brown fine silty sand with a high organic content (Ab horizon). Slightly hard, boundary clear and wavy. Color: 10YR5/3.
3.	Brown to yellow-brown fine-coarse sand and pea gravel. Highly organic, slightly hard to hard. Boundary gradual and irregular. Color 10YR5/4. Contains Occupation I.
4.	Yellow-brown medium sand. Soft, boundary clear and broken. Color: 10YR6/2.
5.	Pale grayish-brown fine sand and redeposited Mazama tephra. Boundary clear and irregular. Lies unconformably on 6. Color: 10YR7/2. Contains Occupation II.
6.	Pale yellow-brown silty fine sand. Slightly soft, boundary clear to irregular. Color: 10YR6/4.
7.	Mazama tephra, primary.
8.	Inter-bedded varicolored silts and coarse sands. Hard to slightly soft, boundary abrupt and irregular. Color: variable.
9.	Cobbles and gravels, slightly loose, boundary indeterminate.
10.	Tan bedded silts and fine sands. Compact, boundary indeterminate. Color: not described.

TABLE 165-2.

SITE 45OK165

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume	29.50					
TSU Position	XII					
Radiocarbon Age	2270±50					
Cultural Style Age	Period IV					
Age Estimate	2200-2350					
FCR						
Count	296					
Weight (kg.)	39.1					
Mean						
Lithics						
Flakes	506					
Common sense categories	25					
Utilized flake	6					
Amor. fl. object	1					
Biface	4					
Projectile point	4					
Scraper	1					
Cove	1					
Tabular knife	3					
Hammerstone	1					
Battered cobble	2					
Chopper	2					
Projectile Point Types	3					
5						
6						
7						
8						
9						
10						
11	1					
12	1					
13						
14						
15	1					

SITE 45OK165

SUMMARY OF CONTENTS

Category	OCCUPATION I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class	17					
1						
2						
3	3					
4	1					
5						
6						
7	2					
8						
9						
10	1					
11						
12	1					
13						
14						
15	1					
16	3					
17						
18	1					
19	4					
Material						
Opal	100					
Jasper/chert, chalcedony	165					
Basalt	29					
Quartzite	21					
Other	190					
Features						
Hearth	4					
Shell/FCR midden	2					
Pits	1					
Earth oven						
Housepit	1					
Form	?					
Diameter or L/W	?					
No. Floors	3+					
Depth	80-100cm					

SITE 45OK165

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains	841					
Unidentified Bone	783					
Unburned						
ct.	527					
wt. (g.)	369.31					
Burned						
ct.	256					
wt. (g.)	168					
Identified Bone	53					
Unburned						
ct.	43					
wt. (g.)	238.84					
Burned						
ct.	15					
wt. (g.)	40.25					
Economic Fauna						
Artiodactyla						
Bos taurus	2(1)					
Ovis aries	1(1)					
Bison						
Ovis canadensis	1(1)					
Odocoilcus sp.	22(2)					
Cervus canadensis	2(2)					
Antilocapra americana						
Carnivora						
Canis spp.						
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris	2(1)					
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatum						
Reptilia						
Chrysemys p.	8(1)					
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45OK165

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae	12					
Cyprinid/ Catostomidae						
Aves	2					
Endemic Rodents	4					
Spermophilus	2(1)					
Microtus	2(1)					
Lagurus c.						
Peromyscus						
Perognathus						
Thomomys						
Mollusca						
Margaritifera falcata	1475					

1. NISP (MNI)

45OK193

This small site spans a pair of narrow ridges and the intervening swale on the upriver side of Orchard Creek (Figure 193-1) 475m downriver from River Mile 590. Located on the Columbia's north bank in T29N, R30E, NE 1/4, SE 1/4, SE 1/4 of Section 1 (W.M.), the site is at an elevation of 326m, m.s.l. (1060'). On the T3 terrace level, it is approximatley 40m (130') above the pre-dam river level. The only surface indications of former human activity are a light scatter of mussel shell and a series of small burial cairns on the ridge crest. The latter is site 45OK194.

Previous Investigations.

This site was recorded by COE archaeologists in 1976 (Munsell and Salo, 1977).

Technique.

Eight 50cm square test pits were dug at intersections of a 15m interval grid (Figure 193-1), in 20cm arbitrary levels. Excavation was stopped where cobbles were encountered, usually between 80-120cm below surface.

Results.

Only 20 unmodified lithic flakes and a few bits of bone and shell were found and those artifacts that were recovered (Figure 193-1) were evenly distributed from 0 to 60cm (Figure 193-2). Rodent action was extensive and most of the bone came from gophers and pocket mice. We were unable to distinguish distinct occupation horizons at this site.

Interpretation.

No information on site age was obtained nor can we make any definitive statement about function.

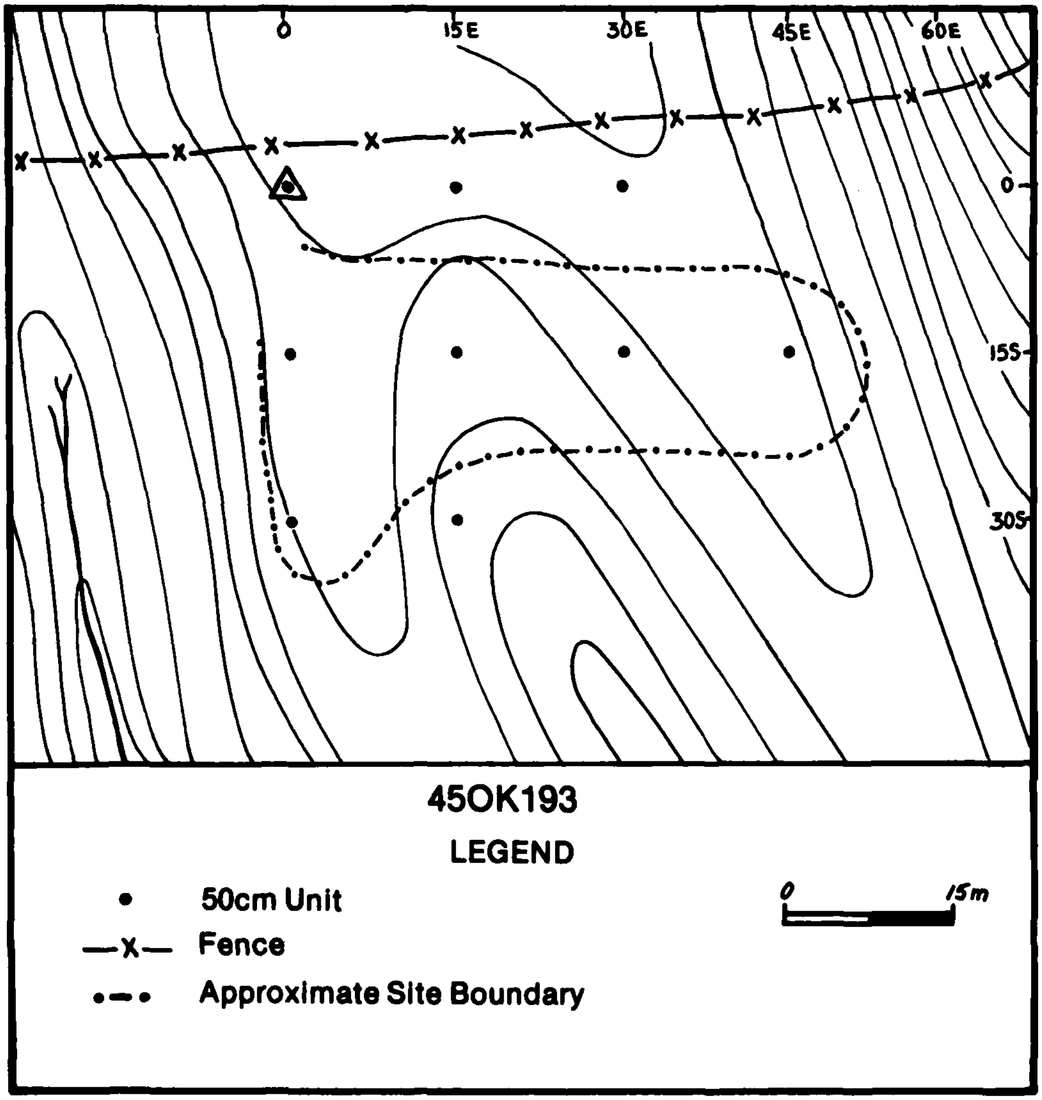

Figure 193-1. Sketch map of 45OK193 contours are approximated.

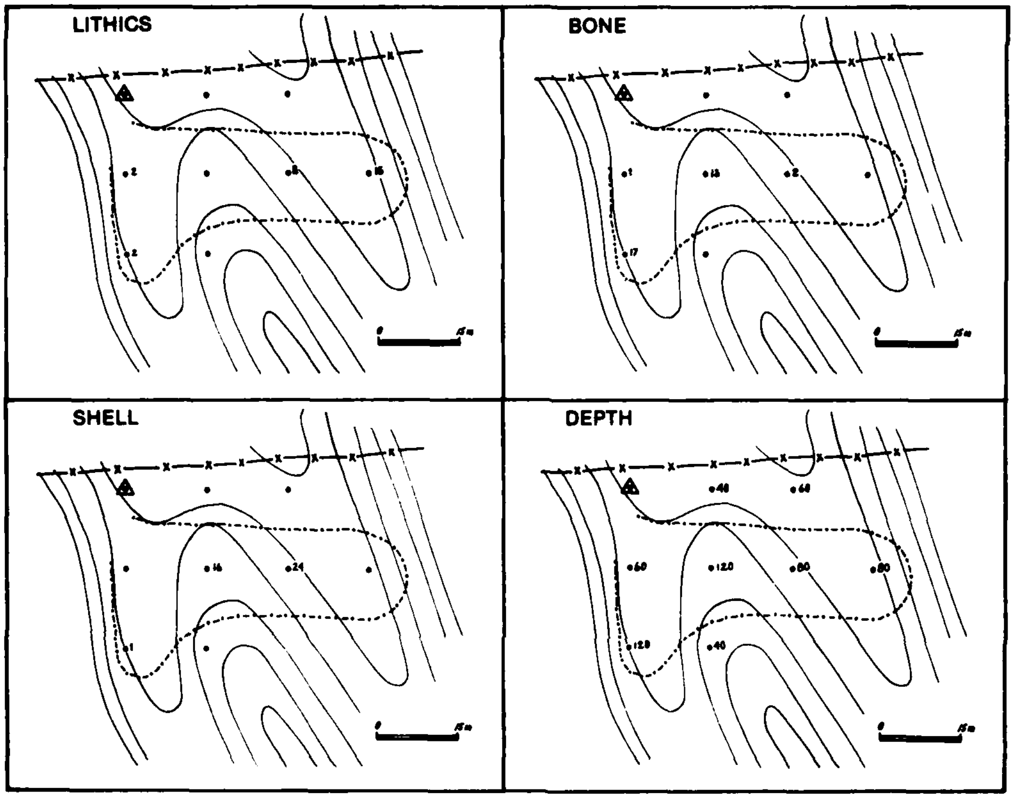

Figure 193-2. Plan views of site 45OK193 showing the densities of artifacts per .25m^2 area.

TABLE 193-2.

SITE 45OK193

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume						5.0
TSU Position						X
Radiocarbon Age						X
Cultural Style Age						X
Age Estimate						X
FCR						
Count						0
Weight (kg.)						0
Mean						
Lithics						
Flakes						30
Common sense categories						0
Projectile Point Types						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

SITE 450K193

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						Not Analyzed
Use Wear Class						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
Material						Not Analyzed
Opal						
Jasper/chert, chalcedony						
Basalt						
Quartzite						
Other						
Features						None
Hearth						
Shell/FCR midden						
Pits						
Earth oven						
Housepit						
Form						
Diameter or L/W						
No. Floors						

SITE 45OK193

SUMMARY OF CONTENTS

Category	I	II	III	IV	V	Unassigned
Faunal Remains						27
Unidentified Bone						27
Unburned						
ct.						3
wt. (g.)						.2
Burned						24
ct.						8.9
wt. (g.)						9
Identified Bone						9
Unburned						3
ct.						
wt. (g.)						
Burned						
ct.						
wt. (g.)						
Economic Fauna						
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis						
Odocoilcus sp.						
Cervus canadensis						
Antilocapra americana						
Carnivora						
Canis spp.						
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris						
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatum						
Reptilia						
Chrysemys p.						
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45OK193

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae						
Cyprinid/ Catostomidae						
Aves						
Endemic Rodents						
Spermophilus						
Microtus						
Lagurus c.						
Peromyscus						
Perognathus						2(1)
Thomomys						7(2)
Mollusca						
Margaritifera falcata						41

1. NISP (MNI)

45OK198

Site 45OK198 is located on the north bank of the Columbia River in T29N, R30E, SE 1/4, NW 1/4, SE 1/4 of Section 1. It lies at an elevation of 326m, m.s.l. (1060') on the T3 terrace, approximately 40m (130') above the pre-dam river level. Using maps supplied by the Seattle District, COE, we identified an area 50-150cm downstream from Corral Creek as archaeological site 45OK198. There is no evidence of prehistoric occupation here, although Euro-American trash is abundant. After excavating nine 50x50cm test pits on a 15m grid (Figure 14A), only one stone flake was found (in Unit 0N/15E).

We have since learned that the map was in error; 45OK199 is in an area immediately adjacent to Corral Creek, inside the fence shown in Figure 198-1. Our excavations have, however confirmed that the western boundary of 45OK198 is just east of our testing grid.

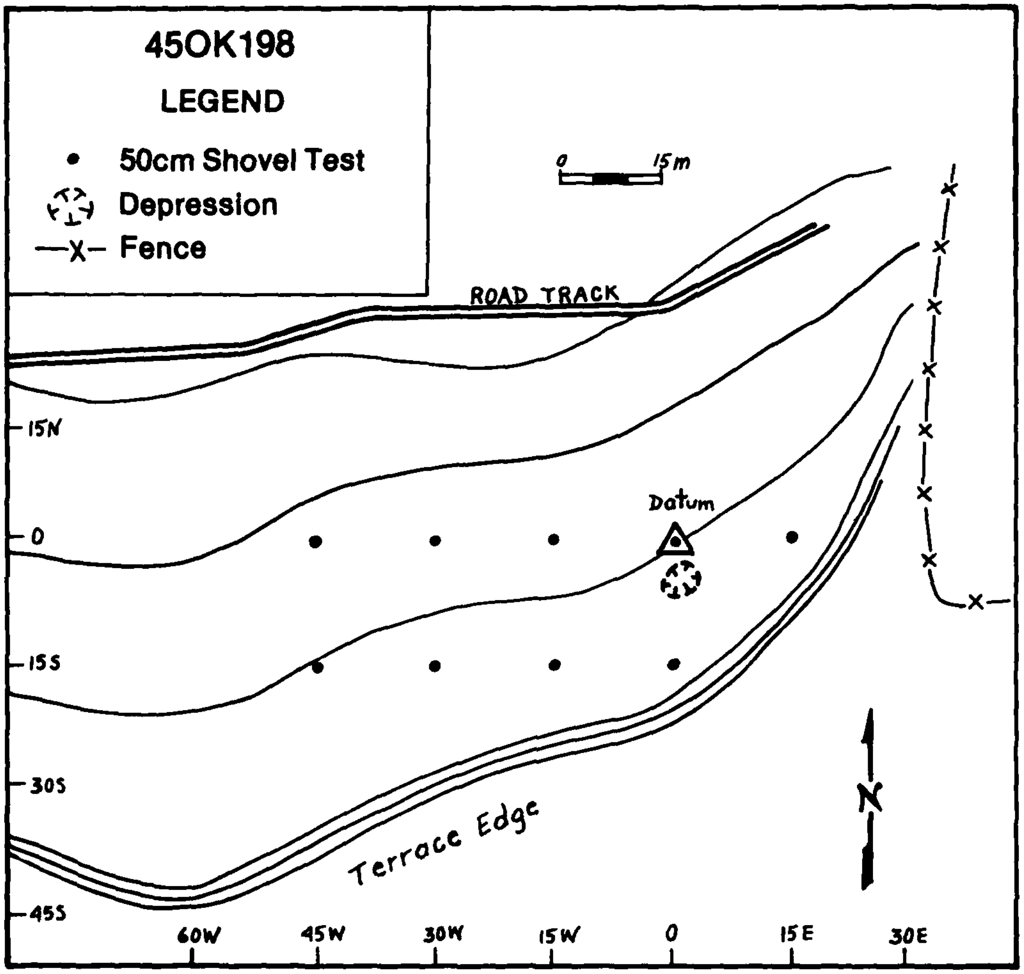

Figure 198-1. Sketch map of 45OK198.

TABLE 198-2.

SITE 45OK198

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume						3.60
TSU Position						X
Radiocarbon Age						X
Cultural Style Age						X
Age Estimate						X
FCR						
Count						186
Weight (kg.)						27.1
Mean						.148
Lithics						
Flakes						1
Common sense categories						0
Projectile Point Types						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

SITE 450K198

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						0
Use Wear Class						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
Material						
Opal						
Jasper/chert, chalcedony						1
Basalt						
Quartzite						
Other						
Features						0
Hearth						
Shell/FCR midden						
Pits						
Earth oven						
Housepit						
Form						
Diameter or L/W						
No. Floors						

SITE 45OK198

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains						
Unidentified Bone						1
Unburned						
ct.						1
wt. (g.)						.2
Burned						
ct.						
wt. (g.)						
Identified Bone						
Unburned						
ct.						
wt. (g.)						
Burned						
ct.						
wt. (g.)						
Economic Fauna						0
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis						
Odocoilcus sp.						
Cervus canadensis						
Antilocapra americana						
Carnivora						
Canis spp.						
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris						
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatun						
Reptilia						
Chrysemys p.						
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45OK198

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae						
Cyprinid/ Catostomidae						
Aves						
Endemic Rodents						
Spermophilus						
Microtus						
Lagurus c.						
Peromyscus						
Perognathus						
Thomomys						
Mollusca						
Margaritifera falcata						0

1. NISP (MNI)

45OK199

This site is situated 80-90m downstream from Corral Creek, 1175m downstream from River Mile 590. It is on the north bank of the Columbia River in T29N/R30E, SW 1/4, NW 1/4, SE 1/4 of Section 1 at an elevation of 306m m.s.l. (995'), 20m (65') above the pre-dam river level.

Shell fragments, a few tiny, stone flakes and single tabular knife of quartzo-feldspathic schist were found eroding from this tiny (7x15m) remnant of the T2. The surface of this terrace remnant slopes steeply (about 30%) toward the river for 7m, then drops precipitously. It is on this precipitous slope that artifacts were observed.

Previous Investigations.

Munsell and Salo (1977) recorded 45OK199 during their Rufus Woods Lake survey.

Procedure.

We excavated three test pits here, 5m apart on the site's long axis (Figure 199-1). Two 50x50cm units were placed near the eroding bank (A and C) the third, 1x1m pit was situated in the exact center of the terrace remnant. Vertical control was 20cm arbitrary levels. Excavation ceased when cobbles impeded further activity (80-120cm).

Physical Stratigraphy. Two strata were observed here: a cobble-rich, loose, light gray-brown loess (Stratum 2, Munsell color 10yr7/2) overlain by a slightly firmer, light brown loess (Stratum 1, Munsell color 10yr6/3). Stratum 1 averages 40cm thick. Although we have no dates, diagnostic artifacts, or ash content data from this location, Stratum 1 appears to belong to TS Unit XIC, Stratum 2 to Unit VII or IX.

Rodent disturbance was extensive here.

Cultural Stratigraphy.

In all test units, mussel shell concentrates in the 20-40cm and 40-60cm depths (Figure 8B) as do the few flakes observed. Bones, and flakes, however showed a less consistent distribution. FCR data cannot be used because of problems encountered in distinguishing them from frost fractured cobbles of natural origin which were common in the colluvium washed from the T3 terrace above.

If we base our conclusion on shell distributions alone, there is a single occupation represented here, located between Strata 1 and 2.

Chronology.

There were no time-diagnostic artifacts found here and no radiocarbon determinations were made. Only the questionable assignment of strata to Time Stratigraphic units can be used for dating this site.

Stratigraphy. If we accept Stratum 2 as representing TS Units VII and IX, and Stratum 1 as TS Unit XIC, then the 45OK199 occupation dates to the end of period I or the beginning of Period II, about 4000-5000 BP.

Artifacts.

There were no identifiable faunal remains or features; two flakes and three cobble tools comprise the tool inventory (Table 199-1). Neither flake was worn. One of the cobbles is a bifacially flaked "chopper" (use-wear Class 16). The second is a unifacial core (unknown), and the third is a hammer stone (Class 4). A few fragments of mussel shell (Margaritifera falcata) were present, but no bone.

This is too small a data assemblage for us to assign functions, especially when so much of the site can be seen eroding down-slope.

Interpretation.

45OK199 is the meager remnant of a once larger site, now eroded away by the Columbia River. It appears to have been occupied between 4000 and 5000 BP.

Erosion of this site is a clear indication that the Columbia was cutting into its north bank between the occupation of this site and the approximate 2000 BP onset of deposition of the TO level below (45OK196, 45OK197). This is yet another bit of evidence for increased river flow between 4700 and 2500 (2000) BP.

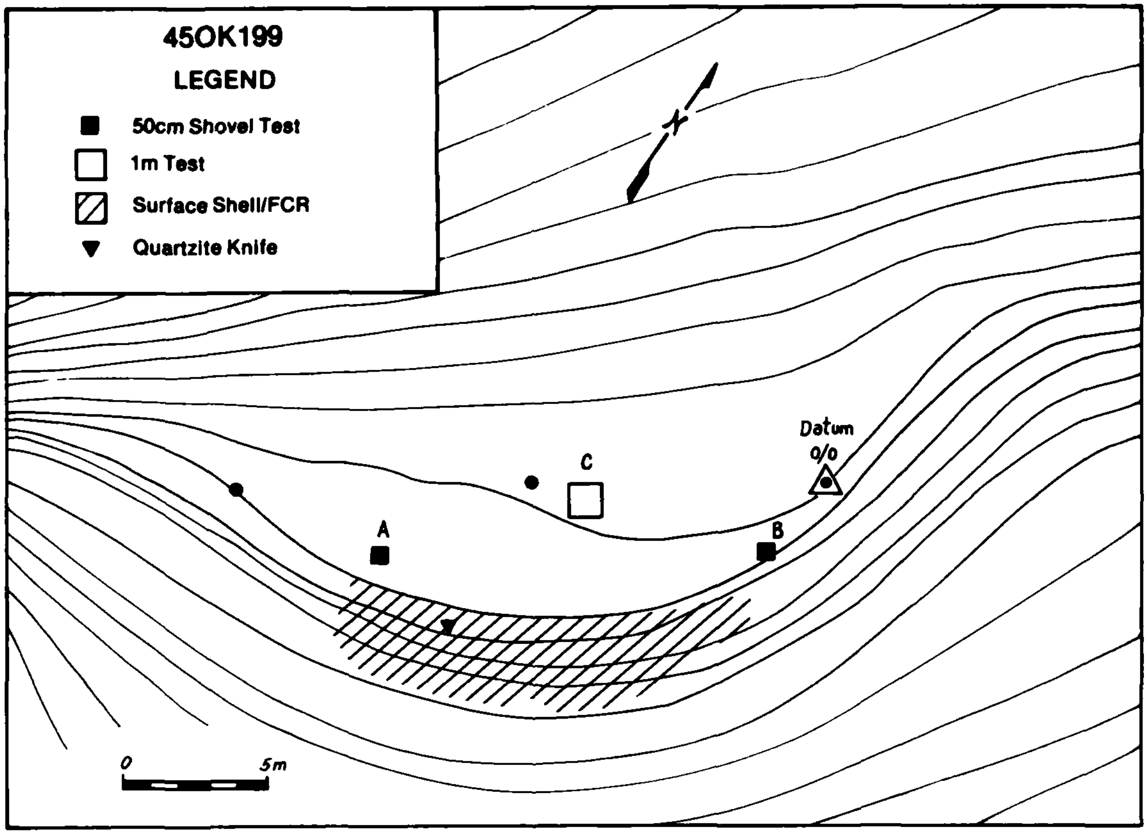

Figure 199-1. Sketch map of 45OK199, showing the location of test pits. Contours are approximate.

TABLE 199-2.

SITE 45OK199

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume	4.40					
TSU Position	XI					
Radiocarbon Age						
Cultural Style Age						
Age Estimate	4000-5000					
FCR						
Count	82					
Weight (kg.)	7.3					
Mean	.089					
Lithics						
Flakes	3(59)					
Common sense categories	3					
Hammerstone	1					
Chopper	1					
Core	1					
Projectile Point Types						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

SITE 45OK199

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class						
1						
2						
3						
4						
5						
6						
7	1					
8						
9						
10						
11						
12						
13						
14						
15						
16						
17	2					
18						
19						
Material						
Opal						
Jasper/chert, chalcedony	1					
Basalt	1					
Quartzite	1					
Other						
Features	None					
Hearth						
Shell/FCR midden						
Pits						
Earth oven						
Housepit						
Form						
Diameter or L/W						
No. Floors						

SITE 45OK199

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains	55					
Unidentified Bone	55					
Unburned						
ct.	49					
wt. (g.)	31.3					
Burned						
ct.	6					
wt. (g.)	3.9					
Identified Bone	0					
Unburned						
ct.						
wt. (g.)						
Burned						
ct.						
wt. (g.)						
Economic Fauna						
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis						
Odocoilcus sp.						
Cervus canadensis						
Antilocapra americana						
Carnivora						
Canis spp.						
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris						
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatum						
Reptilia						
Chrysemys p.						
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45OK199

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae						
Cyprinid/ Catostomidae						
Aves						
Endemic Rodents						
Spermophilus						
Microtus						
Lagurus c.						
Peromyscus						
Perognathus						
Thomomys						
Mollusca						
Margaritifera falcata						

1. NISP (MNI)

45OK205

This small site is on a 50x50m remnant of the T2 terrace level, on the Columbia River's north bank between Corral Creek and the west fork of Fan Creek, at River Mile 589. It is located in T29N/R30E, SW 1/4, SE 1/4, SW 1/4 of Section 1 at an elevation of 118m, m.s.l. (1035'), approximately 32m (105') above the pre-dam river level. Ground cover is sagebrush and bunchgrasses. This small site (Figure 205-1) includes no surface features of any kind. On the upper downriver 1/3 of the terrace are numerous boulders and large angular basalt cobbles that have rolled down from an exfoliated basalt erratic on the T3 above. The site's downriver end is loess covered. A few shell fragments, fire cracked rock and quartzite flakes are the only indications of human activity on the surface. There are no springs or streams nearby, the only potential source of water is a shallow draw just downriver that might from time to time carry runoff from Fan Creek.

Previous Investigations.

This site was discovered and recorded by Munsell and Salo (1977) during their 1976 archaeological survey of Rufus Woods Lake. It has never before been tested.

Technique.

We excavated seven 1x1m and six 50x50cm test pits on a 15m grid over the entire site area (Figure 205-1). Vertical control was in 20cm arbitrary levels. Pits in the rocky upriver half were 50x50cm, in the lower half they were larger. Our reason for varying pit sizes was the assumption that sediments in the rocky area were shallower than elsewhere; this proved to be true. Sediments ranged from 20cm on the upriver end, to 140cm at the downriver end of the terrace.

Physical Stratigraphy.

We have no radiocarbon dates from 45OK205 and, because we originally believed the site to be insignificant and too badly disturbed by natural processes to provide much useful information, we did not submit sediment samples for volcanic ash analysis. We have changed our conclusion, but are currently without a well-documented stratigraphic analysis and must rely only on field description and comparison with other nearby profiles.

As usual on the T2 and T3 surfaces, we begin with a cobble layer left by the ancestral Columbia, TS Unit IV (Figure 205-2). Lying unconformably on this layer are a series of aeolian deposits resembling those observed at 45OK207 and 45OK219.

Stratum 5 is a brown medium to fine silty sand and may correspond to TS Unit IV, an early Holocene aeolian or wind-reworked fluvial deposit. Stratum 4 is a gray brown loess that may or may not contain tephra. A calcium carbonate and silica cemented horizon (Cca/si) obscures the boundary between Stratum 4 and the very fine gray loess of Stratum 3. The latter has a pinkish cast and may be tephra rich, although calcium carborate often imparts a similar color. Bands of light brown and brown loess (Strata 2 and 1, respectively) cap the sequence. These strata may represent TS Units VII, IX and XIC. The Cca horizon probably derives from the 4000-5000 year old Soil I. The lack of A or B horizons between strata 2 and 3 indicates erosional unconformity corresponding to the period of soil formation.

Cultural Stratigraphy.

In most test pits where more than a few artifacts occur, there is a distinct concentration in Stratum 3, above the carborate horizon (Figure 205-2). Because there is no wind deflated lag concentrate at the surface of this stratum, we believe that artifacts were deposited concurrently with Stratum 3 and not on the surface of that layer.

Additionally, artifacts are largely confined to an area of 25x50m in the south and west portions of the terrace (Figure 205-3).

Chronology.

We have no radiocarbon dates from this site, only a weak stratigraphic analysis and a single, fragmentary projectile point. We can thus only tentatively date 45OK205.

Stratigraphy. If, as we have suggested, Stratum 3 is post Mazama (<6700 BP) and the deposition of artifacts at 45OK205 occurred before formation of Soil 1 (4000-5000 BP) then this occupation is attributable to Period I. More precisely it dates between 5000 and 6700 BP.

Artifact Chronology. The single projectile point fragment is a serrated midsection 1.7cm wide with a plano-convex cross-section. Judging from the plan of this fragment, which is widest at its midpoint, this was probably a lanceolate projectile point of the Cascade Type (Lohse's Type 6, 1983). This also places the occupation in Period I.

Artifacts.

There was only one feature in 45OK205; and only 105 stone artifacts and 24 identifiable bones were found.

Features. One discrete layer of mussel shell and scattered FCR occurred in the 30S/15W test pit, between 50 and 60cm. It was not exposed beyond the 1x1m test unit.

Use-Wear. The majority of tools at this site were class 3 (N=6, 50%) with a lower frequency of class 4 (N=2, 17%). Classes 1, 7, 16 and 19 were represented by one item each (Table 205-2). The predominance of Type 3 is unusual and indicates a limitation of activities. Light scraping was the most often repeated stone tool-using activity at this site.

Common Sense Categories. One projectile point fragment, one cobble chopper, one unifacial cobble core, one scraper and one utilized flake comprise the total artifact assemblage at 45OK205 (Table 205-2).

Fauna. Nowhere else in the project area did we find such an unusual faunal assemblage (Table 205-2). Aside from the ubiquitous gopher and one ground squirrel bone, most of the elements came from rattlesnake, king or bull snake (total snakes: 47%, N=8) and various birds (23%, N=4). Deer, elk, dog/coyote, hare and salmonid fish were represented by one bone each. Assuming these are all from economic fauna (we did not find concentrations of snake bones in any other sites, although we excavated many pits in similar environments [45OK207, 45OK199]), we are dealing here with an opportunistic foraging strategy in which a diversity of species were exploited.

Seasonality.

A large proportion of the faunal remains found at 45OK205 were from snakes. Like other reptiles, snakes hibernate and are not available to foraging people between late fall and early spring. We, therefore, conclude that 45OK205 was inhabited during a non-winter season, probably between April and November.

Lithic Utilization.

Among the 100 lithic flakes at 45OK205, the majority were jasper/chalcedony/petrified wood (54%, N=54). Quartzite and opal were in nearly equal proportion (15%, N=15 and 16%, N=16), respectively. The remainder was basalt (4%, N=4) and other, coarse grained materials. There was one flake of obsidian.

Summary and Interpretation.

45OK205 is a sparse, 20x45m artifact concentration on a small remnant of T2. Based on geologic cross-dating and artifact styles, we have tentatively assigned a Period I date between 6700 and 5000 BP. Exhibiting a diverse faunal assemblage including birds and snakes, this site also has a limited assemblage of lithic tools. This information indicates either a residential base for people with a foraging adaptation (Binford 1978a) and opportunistic resource utilization pattern, or a field camp in which a low range of activities were preformed, and animal food gathering was opportunistic.

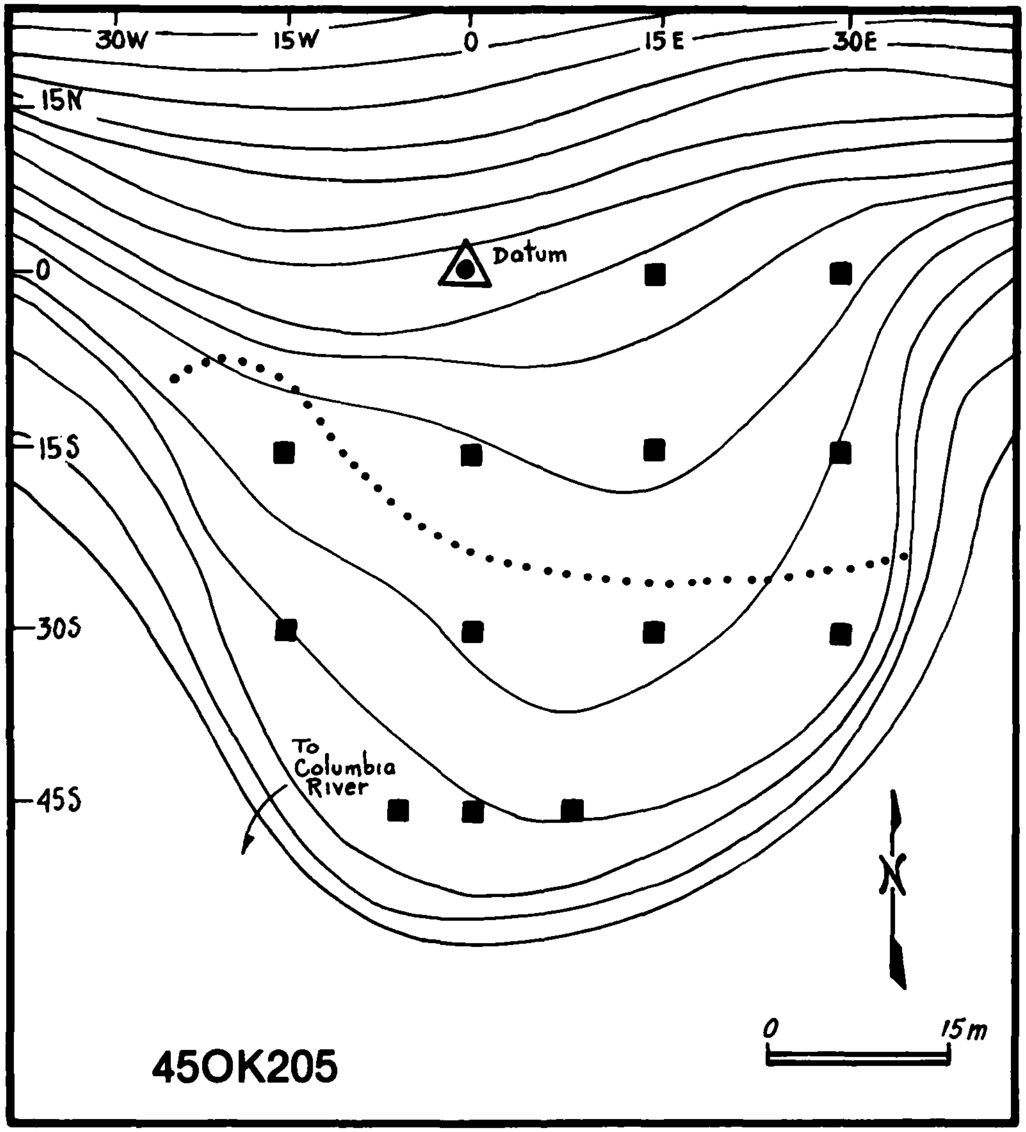

Figure 205-1. Sketch map of 45OK205, showing the location of test pits and approximate site boundary. Contours are approximate.

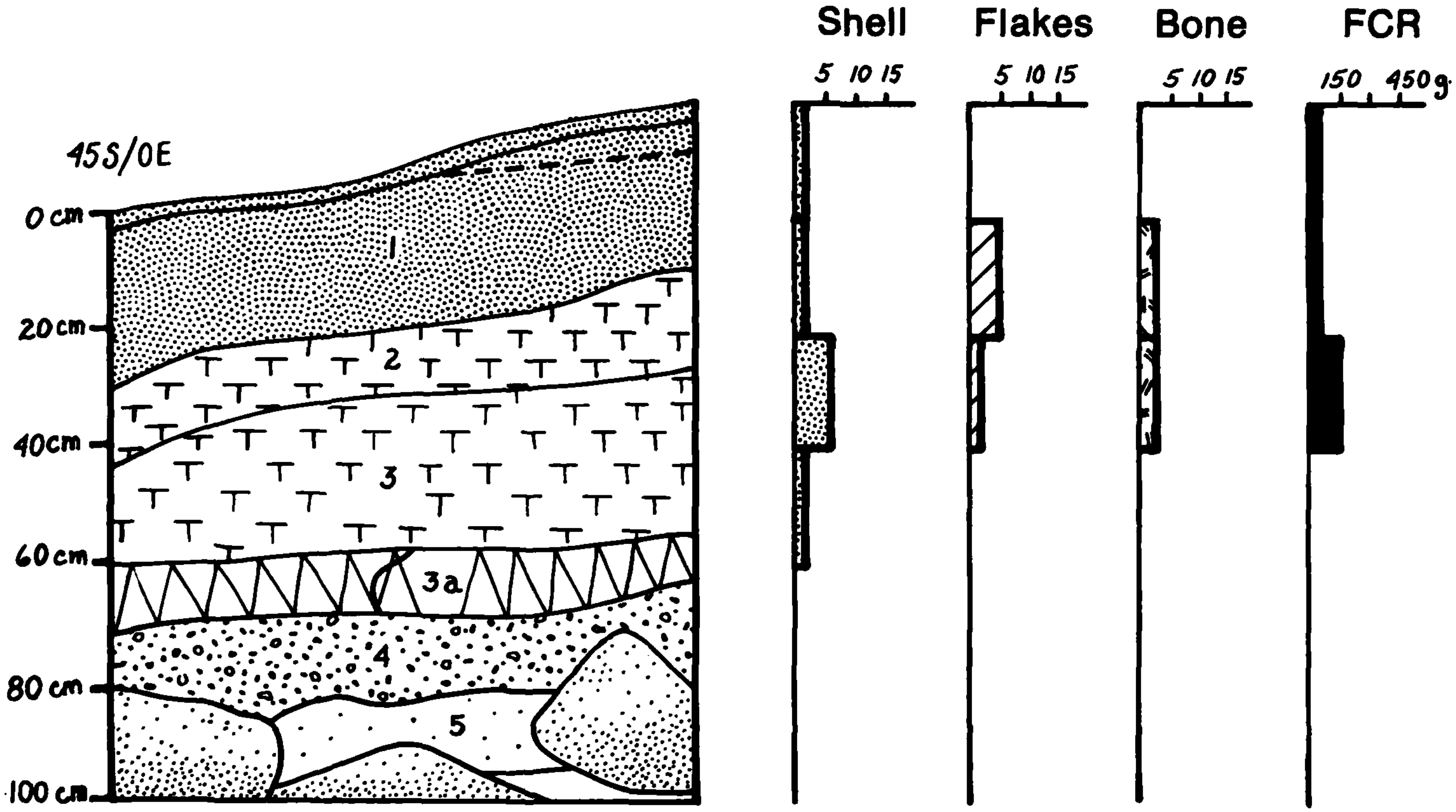

Figure 205-2. Profile of test unit 45D/OE showing the vertical distribution of all general classes of artifacts. Note the concentration in Lower Stratum 3. See Table 205-1 for legend.

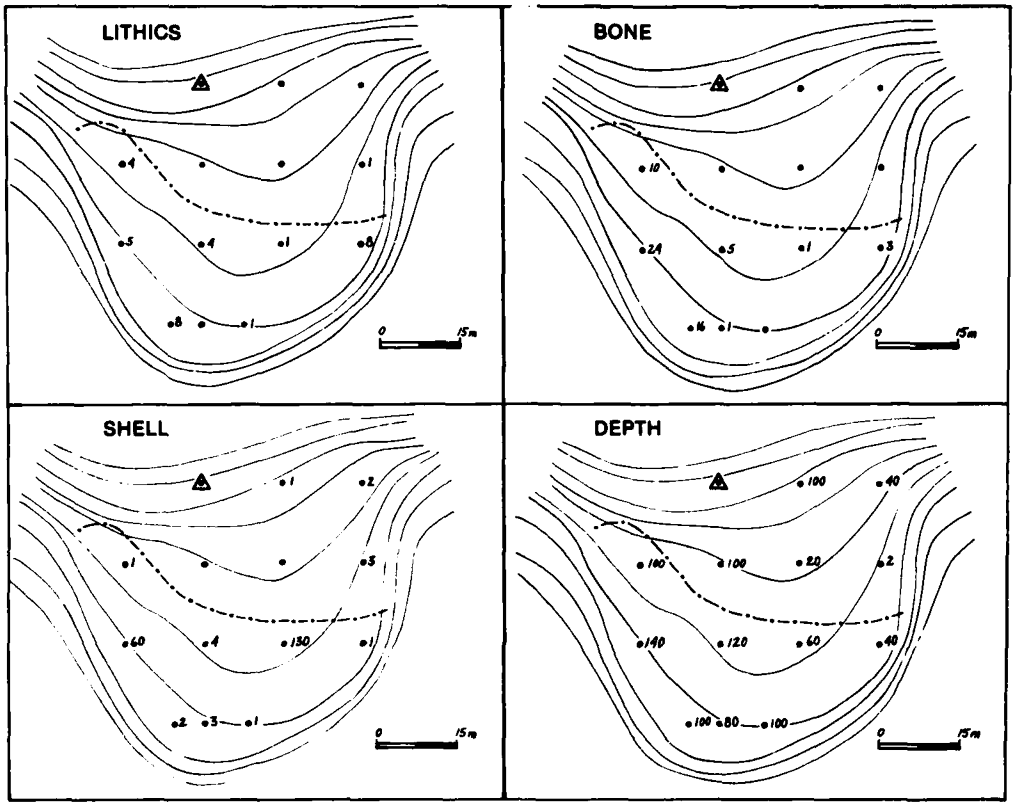

Figure 205-3. Distribution of artifacts and test pit depths for 45OK205.

Table 205-1. Description of Geologic Strata at Site 45OK205

Stratum	Description
1.	Brown very-fine sand (loess), slightly soft with clear wavy boundary. Color: 10YR5/3.
2.	Pale-brown very-fine silty sand (loess), slightly soft to slightly hard, clear, smooth boundary. Color: 10YR6/3.
3.	Gray very-fine silty sand (loess) slightly soft with gradual smooth boundary. Lower horizon in this stratum is silica and calcium carborate indurated and compact. Appears to contain tephra. Color: 2.5Y6/2. Occupation I occurs near stratum surface.
4.	Gray-brown very-fine silty sand. Upper boundary is indurated and compact, lower portion of stratum is soft. Boundary clear and smooth. Color: 10YR5/4-6/4.
5.	Brown medium to fine silty sand. Soft to loose, boundary irregular. Color: 10YR5/3.
6.	Subangular to rounded cobbles to boulders intermixed with sediment of Stratum 5 intermixed.

TABLE 205-2.

SITE 45OK205

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume	8.90					
TSU Position	IX or VII					
Radiocarbon Age						
Cultural Style Age	<4500					
Age Estimate	<5000					
FCR						
Count	36					
Weight (kg.)	8.9					
Mean	.247					
Lithics						
Flakes	100					
Common sense categories	12					
Utilized flakes	9					
Projectile pt. tip	1					
Tabular knife	1					
Hammerstone	1					
Projectile Point Types	1					
5	1					
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

SITE 45OK205

SUMMARY OF CONTENTS

Category	OCCUPATION I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class						
1	1					
2						
3	6					
4	2					
5						
6						
7	1					
8						
9						
10						
11						
12						
13						
14						
15						
16	1					
17						
18						
19	1					
Material						
Opal	16					
Jasper/chert, chalcedony	54					
Basalt	4					
Quartzite	15					
Other	11					
Features						
Hearth						
Shell/FCR midden	1					
Pits						
Earth oven						
Housepit						
Form						
Diameter or L/W						
No. Floors						

SITE 45OK205

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains	205					
Unidentified Bone	158					
Unburned						
ct.	94					
wt. (g.)	22.44					
Burned						
ct.	64					
wt. (g.)	9.78					
Identified Bone	5					
Unburned						
ct.	5					
wt. (g.)	5.8					
Burned						
ct.						
wt. (g.)						
Economic Fauna	17					
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis						
Odocoilcus sp.	1(1)					
Cervus canadensis	1(1)					
Antilocapra americana						
Carnivora						
Canis spp.	1(1)					
Lagomorpha						
Lepus spp.	1(1)					
Rodentia						
Marmota flaviventris						
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatun						
Reptilia						
Chrysemys p.						
Crotalus	5					
Other snake	3					

1. NISP (MNI)

SITE 45OK205

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae	1					
Cyprinid/ Catostomidae						
Aves	4					
Endemic Rodents	7					
Spermophilus	1(1)					
Microtus						
Lagurus c.						
Peromyscus						
Perognathus						
Thomomys	6(3)					
Mollusca						
Margaritifera falcata	695					

1. NISP (MNI)

45OK207

Below the west fork of Fan Creek on the Columbia River's north bank, a broad expanse of the T2 terrace level gradually pinches out into two small, roughly elliptical remnants, each about 70m long. The first of these, separated from the main terrace by the west fork's deep ravine, is 45OK207. The site is 625m downstream from River Mile 589, in T29N/R30E, NE 1/4, SE 1/4, NE 1/4 of Section 2. Its elevation is 315m, m.s.l. (1025'), approximately 29m (95') above the pre-dam river level. Vegetation cover is sagebrush with a grass understory.

Two large, deep housepit depressions and a third, shallower one are the main indications of prehistoric occupancy at this site (Figure 207-1). Shell, fire broken rock and flakes litter the terrace surface and its eroding south bank, concentrated in the vicinity of the housepits. Rodents and their predators have been extremely active here and at least one new gopher mound or badger hole occurs in each 2x2m area; no other disturbance is evident.

As Figure 207-1 shows, housepit depressions are clustered tightly together in the terrace center. The most intact (15m wide and over 1m deep) is HP1. This pit sits farthest back on the terrace and was probably the last to be occupied. To the southeast of and intersecting HP1 is HP2, at least 10m in diameter. This feature has more the appearance of a platform than a pit, its outer rim having been removed by erosion. HP 3 is to the southwest of No. 1 and is at least 4m from its rim. A more distinct depression than No. 2, this 10-11m wide, 50cm deep, roughly circular feature has had its south rim cut by a small surface drainage. Shell and fire cracked rock is most abundant on the ridge between HP1 and HP3 and to the east of HP3. This concentration meets the criteria for a mussel shell and FCR feature. Evidently, then, geologic processes have not fully buried the most recent occupation zone at this site.

Previous Investigation.

Munsell and Salo discovered this site during their 1976 inventory of Rufus Woods Lake. In 1982, Munsell returned to the site and excavated five shovel tests to the southeast and west of the housepit cluster. Cultural material occurred in the upper 80cm of only three pits (Stratum 1, 3, 5) and was most abundant in the 20-60cm levels. No diagnostic artifacts were recovered.

Technique.

An area of 30x40m surrounding the housepit cluster was cleared and surveyed by proton magnetometer. Huggins (Appendix B) noted five large, circular negative anomalies, the most intense of these corresponding to HP1 (Figure 207-1; Appendix B; Figure 1). The area south and west of these anomalies showed high intensity, positive anomalies. After filtering, numerous smaller, positive anomalies could be seen (Figure 207-1; Appendix B; Figures 2, 3). Huggins suggested that these smaller anomalies were midden concentrations, hearths or concentrations of burned rock.

Next, we placed 1x2m test pits in such a way as to 1) provide a sample of site contents in and outside of housepits; 2) to provide a ground truth test of large and small magnetic anomalies identified by Huggins and 3) to determine the size of at least one house and learn how many occupations could be identified in the two other surface-evident depressions. Ultimately, 12, 1x2m pits and a 1x3m trench were excavated at this site (Figure 207-1). Vertical control was 10cm within house pits, 20cm outside of them. Large anomalies A through D all proved to be housepits; no other anomaly was associated with a discernable

cultural feature. We also succeeded in determining the depth, diameter and floor profile of Housepit 1, how many floors had been occupied there, and the number of occupations in each other housepit.

Physical Stratigraphy

Like other T2 sites, 45OK207 is underlain by Nespelem silts and river gravels, on which have been deposited low-bar sands and, later, loess (Figure 207-2, Table 207-1).

Stratum 8, visible only in the ravine west of 45OK207 is undeformed Nespelem Formation silts. Above it is a layer of Columbia River gravel that interbeds with alluvial fan gravels from ancestral Fan Creek (Stratum 7; TS Unit V). As in 45OK165, the next Stratum, 6 consists of interbedded, poorly sorted sands and colluvial sandy silts common to alluvial fan/back terrace environments. This is the local representative of TS Unit Vb.

Lying unconformably on this mixed layer is Stratum 4, a pale yellowish to gray brown loess of TS Unit VII. Stratum 3 is a confusing unit. It is a light brownish gray, very firm loess that appears to be either an eroded Cca/si soil horizon or a slope-wash unit rich in Nespelem silts. It does not react violently to concentrated HCl, yet it has the white veins and firm (nearly hard) consistency of a cemented soil horizon. Particle size analysis has shown it to be the same particle mix as Stratum 4, below. We are interpreting it as a Csi soil horizon, this being the best alternative, given the information available. Both Strata 3 and 4 contain small amounts of Mazama tephra (<2% average/stratum), but its presence is most likely the result of the intensive bioturbation of this entire soil column.

Mazama ashfall probably occurred early in the deposition of Stratum 2, a pale brown loess. Ash content jumps from 2.42% to 5.19% between upper Stratum 3 and lower Stratum 2, declining thereafter to 3.36%. Obviously either the main tephra layer has been eroded from this site (an unconformity between Strata 3 and 2?) or never was deposited at this rather exposed site. Cultural activity is concentrated at the surface of Stratum 2, obscuring its contact with the uppermost, very fine loess of Stratum 1. The occupation on this apparently unconforming contact between Strata 1 and 2 dates 4100 BP. Strata 2 and 3 correspond to TS unit IX.

If Stratum 3 is a Csi horizon, if its development post dates the deposition of Stratum 2 (which the percolation of tephra into this hard horizon might indicate), and if human activity or natural erosion have destroyed the A horizon that should be present at the Stratum 2 surface, then Soil 1 may be represented here. We hesitate to conclude that this is the case.

Nonetheless, Stratum 2 is assignable to TS Unit IX (the post 6700 BP tephra-rich loess) and Stratum 1 to Unit XI (the 4700-2500 BP, fine brown loess).

Cultural Stratigraphy. Vertical distribution graphs (e.g. Figure 207-3) ~~present a confusing~~ picture. In non-house areas, artifacts clearly concentrate between 30 and 60cm below surface, with only one peak in frequency. They are by no means absent in the upper 30cm, however. In HP1, there are two distinct floor layers, each corresponding to a peak in artifact frequency. However, inter-floor deposits and sediments above the floors show continuously high artifact frequencies without apparent modes.

Radiocarbon dates on shell from each house floor indicate that occupation occurred during a brief interval around 4100 BP. These data indicate one long term occupation, with pithouses used sequentially rather than simultaneously. Had use been simultaneous, we would expect a pattern like that seen in 45DO189, wherein artifact frequency declines continuously above the floor level. What seems to have occurred here was that a house was occupied, backfilled by wind action, another excavated and the debris from previous non-house occupation dumped into the old depression(s). Rodents have since homogenized these secondary deposits.

The conclusion that there is but one occupation period is disrupted by the presence of three projectile points (Types 15 and 16) which normally occur in contexts much more recent than the pithouse deposits (Period IV) and their associated projectile points would allow (see Chronology, below). These projectile points were found in the surficial midden deposit south of HP1 and in the upper few centimeters north of that house. All three artifacts occurred in the upper 30cm of the site.

Just below the surface in HP1 is a thin deposit of organics, charcoal and artifacts that marks a final occupation of that feature. Because 1) Period IV projectile points occur near the surface (above the main occupation zone of this site) associated with 2) a surficial midden deposit of shell and rock located in front of 3) HP1, (the most recently re-excavated of the houses at this site) in which a late, near-surface floor layer occurs, we conclude that there was a second and final occupation of this site during Period IV.

Because there were no clear breaks in the vertical distribution of artifacts (the more intense, longer-term early occupation dominates the graphs) it was necessary to separate the upper and lower occupations by grouping arbitrary levels. Occupation I comprises all artifacts and features within 30cm of the surface; Occupation II, all materials below that level. Mixing between occupations is a certainty. Because Occupation I is relatively lighter and shorter term, it probably contains a large proportion of Period II artifacts. The presence of Type 5 and 6 projectile points in Occupation I supports this argument; these types are ordinarily confined to Period II.

<u>Chronology</u>.

We have already alluded to the fact that Occupation I dates to Period IV and Occupation II to Period II. Reasons for those assignments follow.

<u>Stratigraphy</u>. Occupation II lies at the surface of the ash rich, post-Mazama loess of TS Unit XI and beneath the fine brown loess of TS Unit XI. Occupation II should, therefore, date in the range of 4000-5000 BP. Deposited atop Unit XI, Occupation I should date either late in the period 4700-2500 BP or after 2500 BP.

<u>Artifact Chronology</u>. Projectile point styles provide the basis for assigning the two occupations to time periods. In Occupation I the following types are represented: Type 15A (N=1); 16B (N=1); 8E (N=1); 5 (N=1); 6 (N=1). Specimens of Type 5 and 6 are probably from Occupation II, since these types occur 1500 years or more earlier than Types 15 and 16.

Occupation II contains projectile point Types 6 (N=3), 7 (N=1), 8 (N=2), 11 (N=3), 12 (N=1) and 14 (N=1). Except for the Type 14 specimen, which may belong in Occupation I, this is a typical early Period II assemblage (cf. Lohse 1983).

Radiocarbon Dating. We obtained four dates from this site, all on shell and all from house floors: HP1, 3950+-70 BP (Beta 5260) (uncorrected for isotopic selectivity); HP2, 4100+-80 BP (Beta 6266); HP3, 4090+-110 BP (Beta 6268); and HP4, 4110+-90 BP (Beta 6267). If it follows the pattern of the three already-corrected dates, the HP1 sample probably would correct to around 4200 BP. We conclude that occupation II at this site was occupied briefly, but on several separate occasions between about 3980 to 4270 BP.

There are no radiocarbon dates on Occupation I.

Function.

Features. Four of the large, negative anomalies found by magnetometry proved to be housepits. HP's 1, 2, and 3 were already visible on the surface, number 4 was not. A brief description of each follows:

> Housepit 1. We excavated a series of three test pits north-south across this feature and found that it contained three floor levels (Figure 207-4). The first was 170-175cm below surface at the time of occupation and has a 10m diameter. The pit has walls sloped at 30 degrees and, with this added would be about 12m across (much like HP1, 450K11). Bone fragments shell, fire broken rock and organic staining are present in this, most distinct floor level. Two other concentrations of artifacts and organic staining (floor levels) could be distinguished, one at 80-100cm (at least 60-90cm below the main occupation surface) and a third at less than 20cm below modern surface (1m below the surrounding terrain). The lowest floor is level, the second slightly basin shaped and the third more basin shaped still. Second and third floors do not extend across the entire housepit, and would have been under 10m in diameter. Because it occurs at or near the Occupation II surface (Figure 207-4) the second floor level may simply be a concentration of debris in a slightly low spot on the former land surface. If it was a housepit floor, it would have been a shallow one. This is also true of the third floor, which we do not interpret as a house deposit. With our limited data, we cannot determine the house outline for any period, but it was probably circular or square.

> Housepit 2. The single shell, bone and rock littered floor of this housepit is 1.2-1.3m below the present surface, thus about 80-100cm below the occupation surface 4100 years ago. Only one 1x2m pit was excavated here and it did not intersect the house wall.

> House pit 3. Again, we excavated only one 1x2m pit and missed the house rim. The single floor level of this house is at 120-140 cm beneath the 4100 year surface (Figure 207-5). Fire broken rock is scattered over the floor in the area intersected by our test pit (near the southeast rim?). An 80cm deep, 80cm diameter pit (Figure 5H) had been dug below the house floor and

gradually backfilled with sand and cultural material. We interpret this as a storage pit.

Housepit 4. The only test pit we excavated in this feature contained little until a thick shell and fire broken rock midden was encountered at a depth of 160-180cm. In association with a dark organic stain, this midden evidently was deposited on the house floor. House 4 is situated in anomaly D, directly in front of (south) of HP1. Although slight ridges were evident around what was probably the house rim, the steep sloping terrace bank (post depositional erosion) made this feature difficult to perceive on the surface.

Housepit 4 almost certainly would have intersected HP2, and these two are probably not contemporaneous.

In fact, no more than two of the four housepits (HP3 and one other) could have been occupied simultaneously. Housepits 2 and 4 overlap each other, as do HP1 and 2. Only HP3 is separate. Also, HP1 was used twice in Period II, with over 40cm of sand being deposited between uses. These data suggest that the site was intermittently occupied over a period of two or more centuries, with enough time elapsed between visits that old houses filled in and new ones had to be excavated. The sequence of occupancy appears to have been HP4, HP2, HP1. Occupancy of HP3 probably predates HP1, since HP3 is filled with Occupation II debris.

Only the uppermost "floor" of HP1, if indeed it represents a pithouse use of this site, is attributable to Occupation I; all others belong to Occupation II.

Both occupations contain shell and FCR middens, but no distinct hearths were observed. Intense rodent activity may account for the destruction of such small features but we may also have simply missed them.

Use-Wear. There were 76 tools in Occupation II (Table 207-2), only 16 in Occupation I. Tool classes 3 (28%, N=21), 16 (21%, N=16) and 19 (17%, N=13) dominate the Occupation II inventory, with all other classes present in low frequency (<9%).

Occupation I lacks the heavy cutting and scraping tools (classes 15, 16) and contains mostly class 7 (hammerstone-like tools, 31%, N=5), class 3 (31%, N=5) and class 19 (19%, N=3). Classes 1, 4 and 6 are also present as one item each. [Note, the Type 5 and 6 projectile points have been removed from this assemblage because they clearly are derived from the older occupation]. This unusual assemblage (with light scraping tools, hammers and projectile points), appears to represent a restricted set of activities, perhaps the processing of game. It may also, however, be an artifact of the arbitrary process used to distinguish occupations at this site.

Common Sense Tool Categories. There were 4 projectile points (two representatives of older types deleted because they probably represent mixing), 3 bifaces, 3 utilized flakes, one uniface retouched flake, a spokeshave, a tabular knife and 5 hammerstones among 8 objects found in Occupation I. In Occupation II there were 13 projectile points (15 counting those from Occupation I), 7 bifaces, 18 utilized flakes, a uniface retouched flake, one drill, 4 gravers, 3 scrapers, 2 spokeshaves, 25 tabular knives, 2 hammerstones, 2 bone awls, 2 shell beads, an elk canine-shaped slate pendent, one probable milling stone

(abrasion wear, not pitting) and a net sinker notched by pecking.

Fauna.

Faunal assemblages of the two occupations are also distinct, but sample size differences may be at least partially responsible (Table 207-2). Only four elements could be identified from the Occupation I: 2 deer, 1 mountain sheep, 1 marmot.

Occupation II contained our largest faunal assemblage, identified elements, of which 37 were endemic rodents. With rare exception, all elements are from salmonid fishes (40%, N=62), deer (37%, N=57) and turtle (11%, N=18). Non-salmonid fish, marmots, hare, dog or coyote, mountain sheep and bison also were present at <3% each. This is the most recent occurrence of hare and dog/coyote in the RM 590 Study Area. It is also one of only two occurrences of bison.

Seasonality.

As usual we have no unequivocal data on seasonality. Turtles are most easily taken during the spring-fall period of activity, but could represent shells curated as utensils or amulets. Winter is the ethnographic season for housepit use, but can we extend that record 4000 years?

Lithic Utilization. Lithic material frequencies for the two occupations are very similar, probably reflecting both their geographic location relative to lithic sources and the degree of mixing between them (Table 207-2). Of 637 objects in Occupation I, 13% (N=83) are opal, 67% (N=428) are jasper/chalcedony/petrified wood. Only 2.7% (N=17) are basalt; 15.4% (N=98) quartzite and the rest indeterminate. Occupation II has 1922 objects, of which 9.2% (N=176) are opal, 72.9% (N=1401) jasper/chalcedony/petrified wood, 4.1% (N=78) basalt and 12.2% (N=235) quartzite. The jasper/chalcedony dominance of Occupation II is typical of Period II pithouse occupations within the RM 590 Study Area.

Summary and Interpretation.

45OK207 is located on T2 terrace level overlooking the Columbia River at the mouth of Fan Creek (west fork). It is a two occupation site. Occupation II is a 4100 year old (Period II) winter/base camp containing five house occupations in four housepits. No more than two of these pits were inhabited at any one time. Deer and salmonid fishes provided the bulk of protein at the site, but turtles were also used frequently. There is an apparent storage pit in the floor of one house, demonstrating that food storage technology had been developed by this time.

Occupation I is problematical. Having been arbitrarily separated from the lower occupation, this assemblage is small and in many ways unusual. One housepit may or may not have been used as a pithouse during this Period IV habitation of the site. This occupation, while tentatively identified as an ungulate procurement camp, should be used with caution in any effort to delineate Period IV settlement patterns.

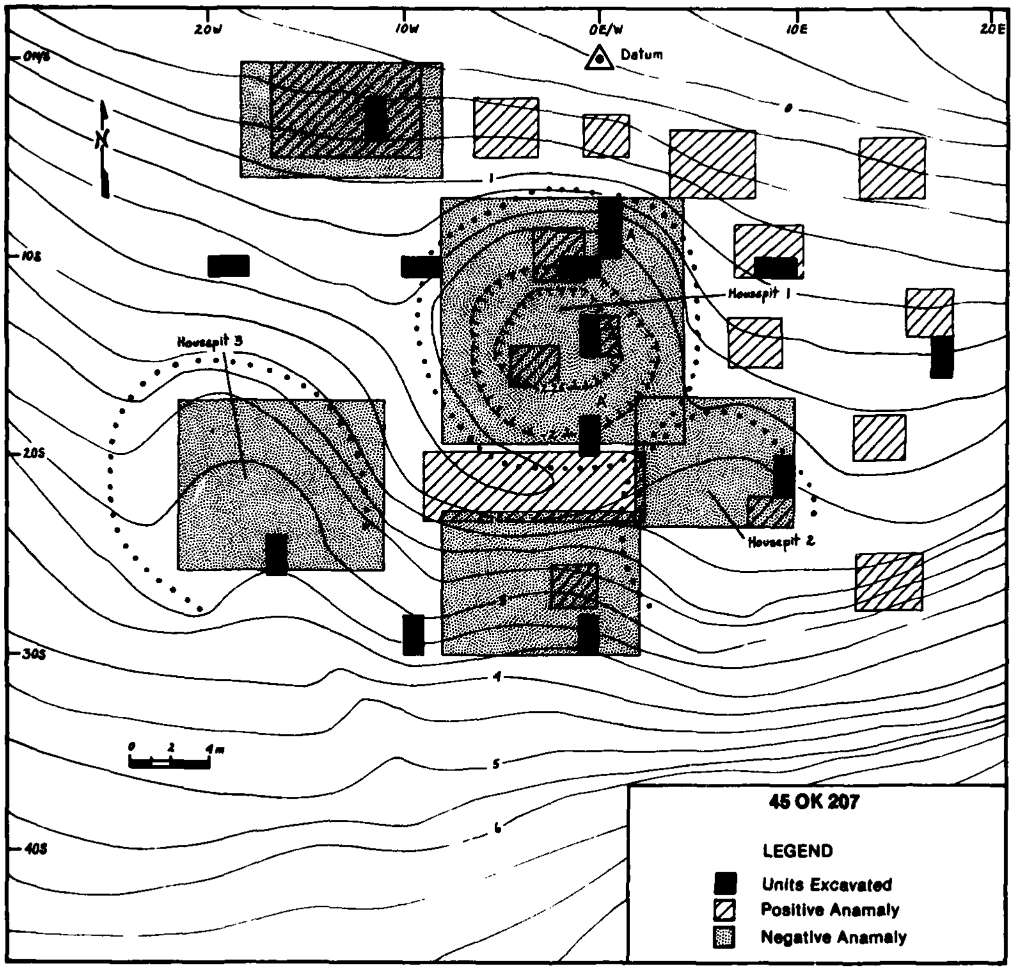

Figure 207-1. Topographic map of site 45OK207 showing locations of magnetic anomalies and test pits. Contour interval is 25cm between 0 and 3m below datum and 50cm between 3 and 8m below datum.

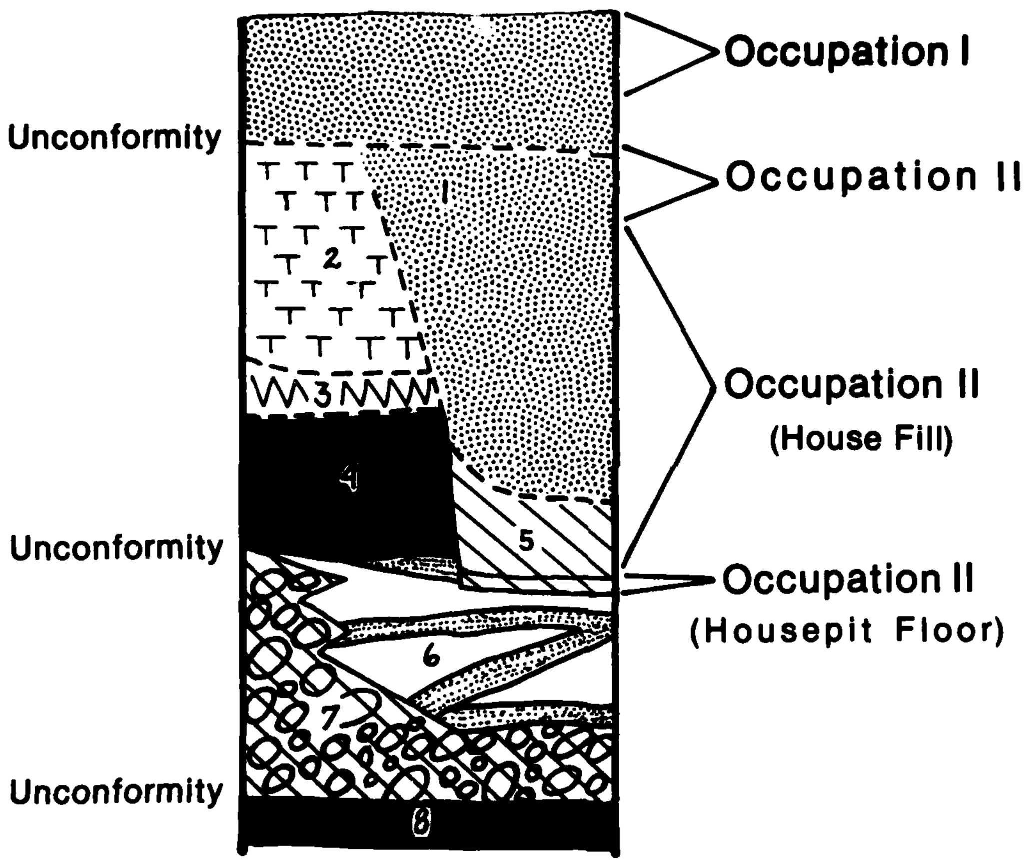

Figure 207-2. Schematic profile of 45OK207 showing the position of housepit excavations relative to underlying strata. See table 207-1 for descriptions.

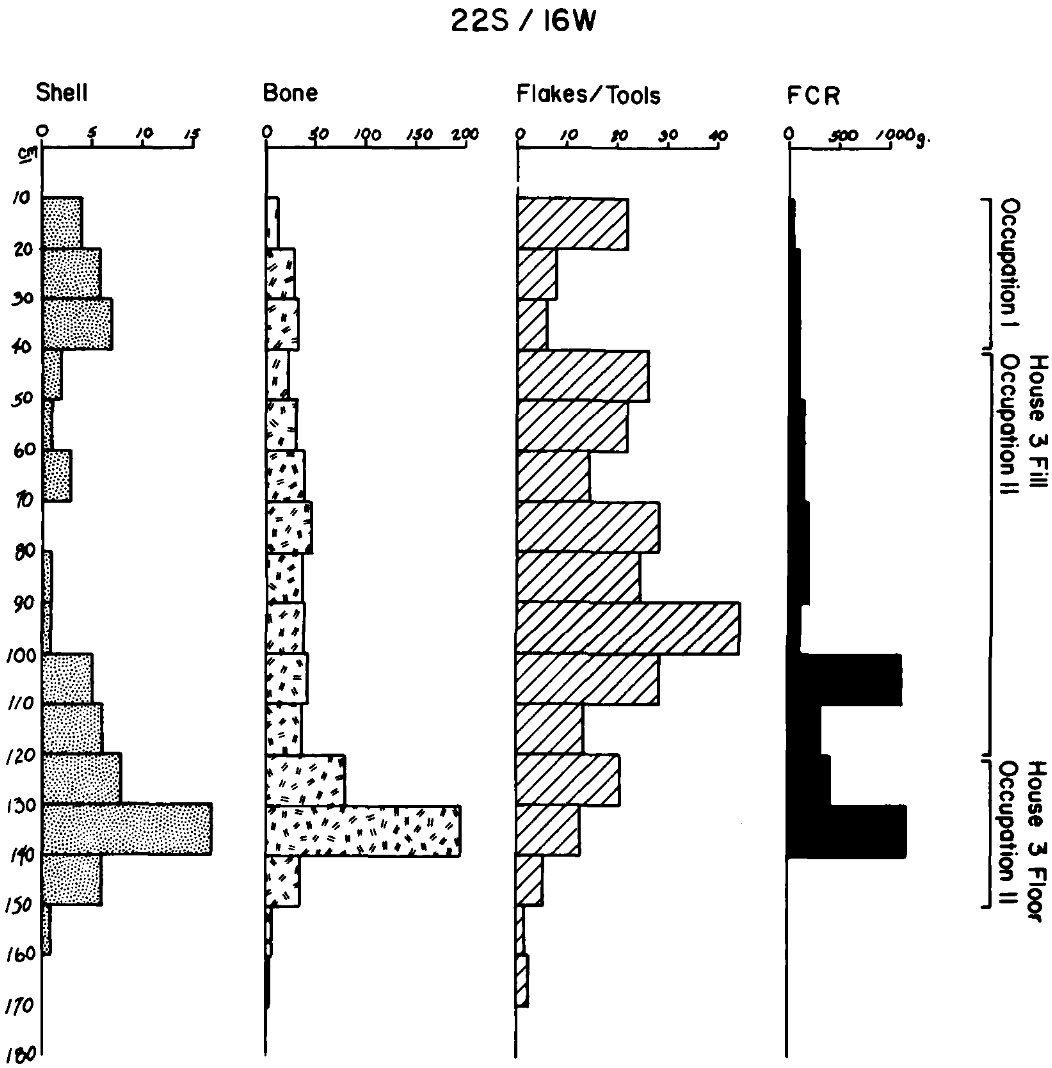

Figure 207-3. Artifact frequency graphs for an example test unit at 45OK208. Unit is that shown in Figure 207-5.

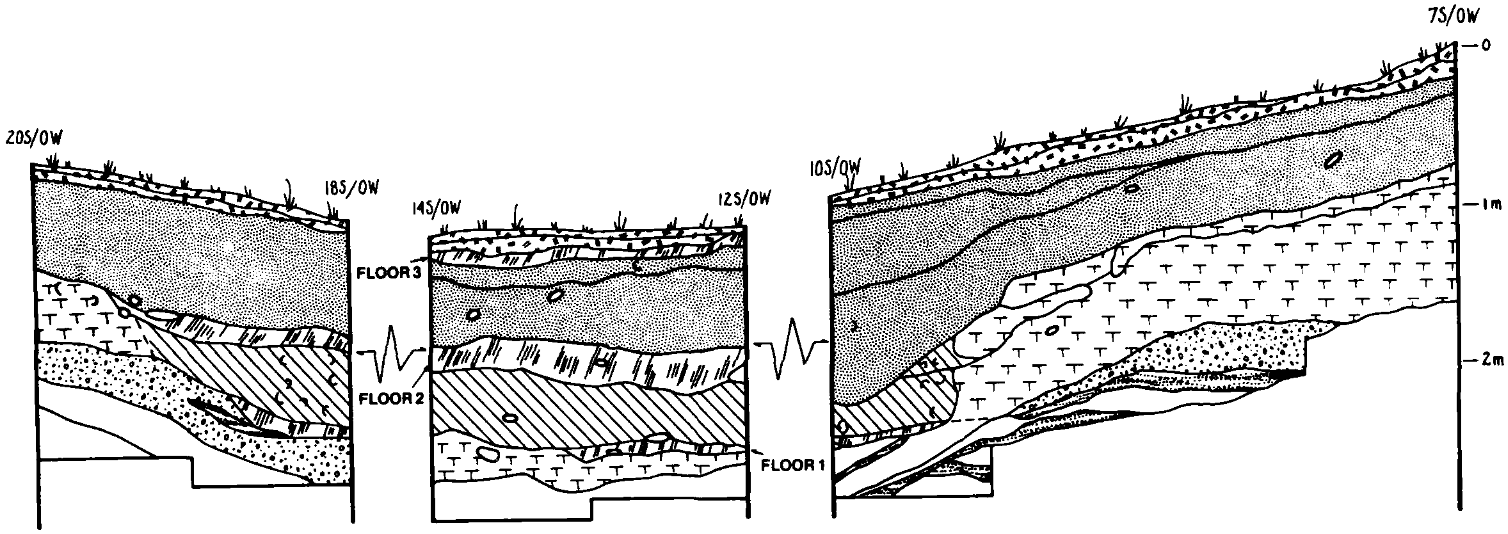

Figure 207-4. North/South profile of House 1, 450K207. For legend see Chapter 5, Figure 9.

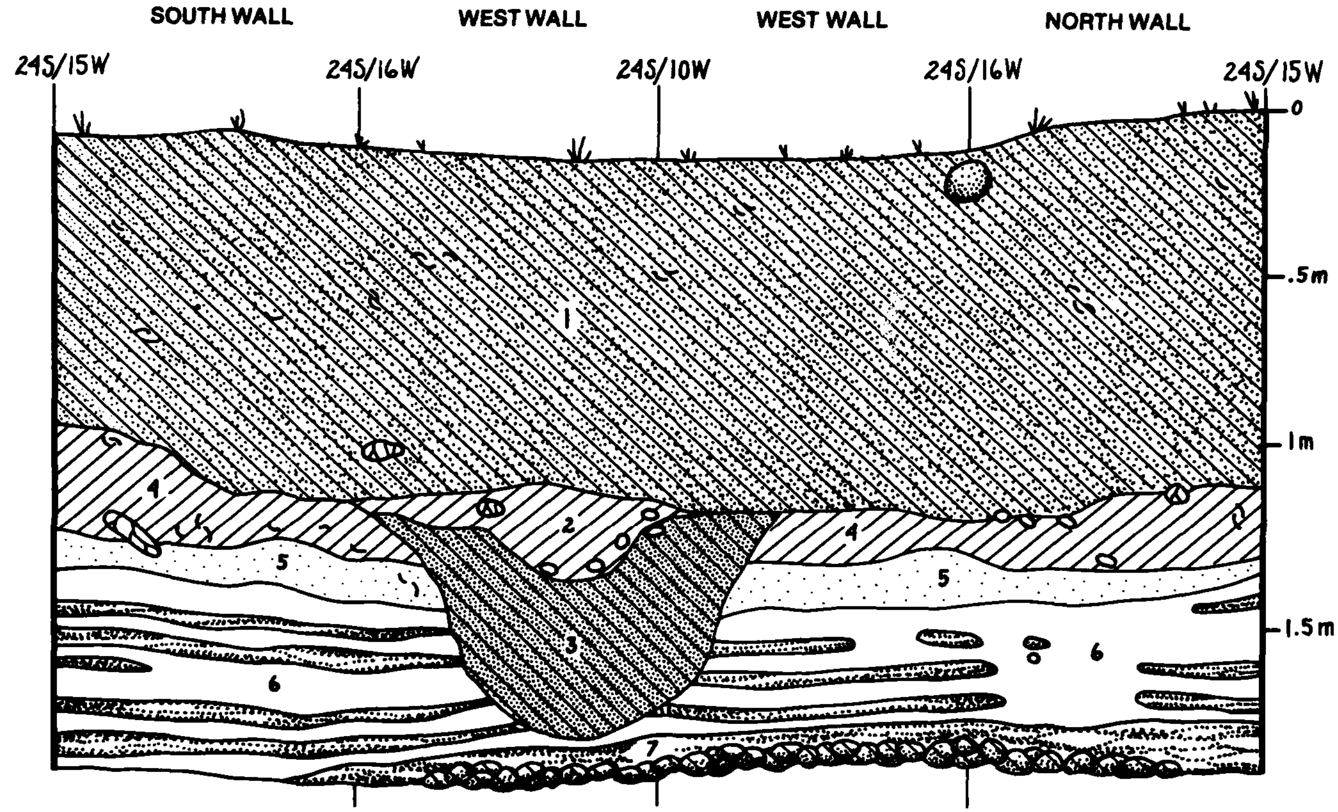

Figure 207-5. Profile of test pit through Housepit 3, showing a pit feature in the housepit floor. Legend is Table 207-1.

Table 207-1. Description of Geologic Strata at Site 45OK207.

Stratum	Description
1.	Brown to gray fine to very fine sand with a few coarse particles. Contains some tephra slightly hard to soft, boundary gradual. Color: 10YR5/2-5/3. Occupation I is at the surface, Occupation II near the base of this stratum.
2.	Pale brown fine silty sand with some tephra. Soft to slighly hard boundary gradual and irregular. Color: 10YR6/3. Occupation II is at the surface of this stratum.
3.	Light brownish gray silty fine sand contains some tephra. Hard to slightly compact, boundary gradual and irregular. Appears to be silica-indurated Stratum 2. Color: 2.5Y6/2.
4.	Pale yellowish-grayish brown silty fine sand. Hard boundary clear and smooth. Color: 10YR6/3.
5.	House floor deposits. Brown, fine silty sand with high midden and organic content. Color: 10YR5/3.
6.	Interbedded layers of medium to fine sands and sandy silts. Color variable, but usually light brownish gray. Hard, boundary clear and irregular.
7.	Subangular to rounded cobbles and gravels, poorly sorted and mixed with Stratum 6. Hard, boundary indeterminate.
8.	Tan bedded silts and fine sands. Hard, boundary indeterminate. Color: 2.5Y8/2.

TABLE 207-2.

SITE 45OK207

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume	5.70	23.9				
TSU Position	Surface XIc	Between IX and XIc				
Radiocarbon Age		$\bar{X}4125 \pm 90$				
Cultural Style Age	2500-1600	3500-4500				
Age Estimate	<2500	4000-4200				
FCR						
Count	305	1197				
Weight (kg.)	225	139.9				
Mean	.073	.116				
Lithics						
Flakes	637	1922				
Common sense categories	22	84				
Utilized flake	3	18				
Unifac. ret. flk.	1	1				
Amor. fl. object		2				
Biface	3	7				
Projectile point	7	13				
Drill		1				
Graver		4				
Scraper		3				
Spokeshave	1	2				
Core		1				
Tabular knife	1	25				
Hammerstone	5	2				
Edge battered cobble		2				
Net sinker	1					
Bead		3				
Projectile Point Types	5	11				
5	1					
6	1	3				
7		1				
8	1	2				
9						
10						
11		3				
12		1				
13						
14						
15	1	1				
16	1					

SITE 45OK207

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class	16	77				
1	1	5				
2						
3	5	21				
4	1	6				
5		3				
6	1					
7	5	3				
8		1				
9						
10						
11						
12		1				
13						
14		1				
15		7				
16		16				
17		1				
18		1				
19	3	13				
Material						
Opal	83	176				
Jasper/chert, chalcedony	428	1401				
Basalt	17	78				
Quartzite	98	235				
Other	11	31				
Features						
Hearth						
Shell/FCR midden	1	2				
Pits		1				
Earth oven						
Housepit		4				
Form		Round/square				
Diameter or L/W		10-12m				
No. Floors		5				

SITE 45OK207

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains						
Unidentified Bone						
Unburned						
ct.						
wt. (g.)						
Burned						
ct.						
wt. (g.)						
Identified Bone	4					
Unburned						
ct.						
wt. (g.)						
Burned						
ct.						
wt. (g.)						
Economic Fauna	4	150				
Artiodactyla						
Bos taurus						
Ovis aries						
Bison		1(1)				
Ovis canadensis	1(1)	3(1)				
Odocoilcus sp.	2(1)	57(2)				
Cervus canadensis						
Antilocapra americana						
Carnivora						
Canis spp.		3(1)				
Lagomorpha						
Lepus spp.		1(1)				
Rodentia						
Marmota flaviventris	1(1)	3(1)				
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatum						
Reptilia						
Chrysemys p.		18(2)				
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45OK207

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae		62				
Cyprinid/ Catostomidae		4				
Aves		2				
Endemic Rodents		37				
Spermophilus		2(1)				
Microtus		3(2)				
Lagurus c.						
Peromyscus						
Perognathus						
Thomomys		32(7)				
Mollusca						
Margaritifera falcata	396	9775				

1. NISP (MNI)

45OK208

This small site is located at the upriver end of T2, on the toe of an inactive alluvial fan just downstream from the west fork of Fan Creek, 900m downstream from River Mile 589 (Figure 208-1). Situated on the north bank of the Columbia River, the site is in T29N/R30E, NW 1/4, SE 1/4, NE 1/4 of Section 2 at an elevation of 310m, m.s.l. (1010'), about 25m (80') above the pre-dam river level. Across Fan Creek is site 45OK207, just downstream is a small, shallow drainage channel that may formerly have been a mouth of Fan Creek. The terrace slopes gently (<10%) then drops precipitously (50% or more) to the reservoir shore, which is naturally armored by cobbles and boulders.

A thin scatter of shell fragments and flakes is the only surface evidence of human occupancy; it is most common along the eroding terrace edge.

Previous Investigations.

Like most sites we have tested, 45OK208 was recorded by Munsell and Salo (1977). Seattle District archaeologists returned to the site in 1982 and excavated two shovel tests. They found shell and fire broken rock to a depth of 80cm, where cobbles were encountered, embedded in firm, yellow clay. Artifacts were concentrated between 20 and 60cm below surface, but were not abundant.

Technique.

An area 75mx40m was gridded at 15m intervals and eight 1m squares and eight 50cm squares were excavated to cobbles or clay hardpan (Figure 208-1). Secondary excavation consisted first of 1x2m pits scattered at intervals over the site area and later, after features of special interest were identified, included two larger blocks (one in the northwest, the other in the southwest corner of the site area). Finally, to confirm site boundaries, we excavated seven additional 50cm test holes in the eastern area of our original grid.

Two backhoe trenches were cut to help us connect the site area stratigraphically with the adjacent alluvial fan (Figure 10A).

Physical Stratigraphy.

Despite this site's proximity to 45OK207, the two areas are stratigraphically quite different. 45OK207, situated just outside the upriver edge of a small alluvial fan, consists primarily of drifted loess in the fan's leeward side and up against the T3 escarpment. At the toe of that same fan, 45OK208 is exposed to both wind and water erosion and its sediments are colluvial. Figure 208-2 is a schematic profile for the site area, Table 208-1 presents a simplified description of the sediments.

The sequence begins with Stratum 5, a mixture of Columbia River cobbles and clastic silty yellow clays. The cobbles correspond to TS Unit IV, but the clays are more recent, containing small amounts of Mazama tephra (Appendix D). In our backhoe trench, the massive land-slide stratum unconformably overlies sands of TS Unit Va in a thickness of over 1m, thinning out and lying directly on cobbles in the site area. Apparently the landslide, or water preceeding it, scoured Unit V and probably Unit VI and VII sediments as well from the outer terrace. Clays settled among the remaining cobbles, forming a nearly impermeable, cemented stratum.

Over this clay lies Stratum 4, a brown silty fine sand with a few pebble and coarse sand particles. Small amounts (<2%) of Mazama tephra occur here also. The stratum is a mixture of aeolian and colluvial sediments, with the latter seeming to dominate. A well developed soil is present, with a dark grayish brown, organics and pollen-rich (20% pollen) A horizon up to 10cm deep, and a clay enriched B horizon. Bioturbation, in the form of small insect and rodent burrows and root casts, is extensive, and occurred as the soil formed. Artifacts occur at the soil surface and have penetrated the soil column through the same bioturbation. Stratum 4 corresponds to TS Unit IX, the soil to Soil I. The unusual degree of soil formation here is due to a combination of climatic factors (abrupt increase in moisture availability), a lack of sedimentation and the impermeability of Stratum 5 clays. The area would retain water longer, promoting plant growth and thus the build up of organics and weathering of clays from the soil surface.

Stratum 4 is overlain by a massive, (single event?) layer of alluvial fan gravels. In some areas the boundary is level; elsewhere, such as the site's southeast corner, this colluvial event resulted in some erosion of Stratum 4 before Stratum 3 was laid down. In the north and northeast site areas, this stratum is up to 30cm thick and continuous. Elsewhere, it is thin and discontinuous. In the southwest excavation block, it is represented by an erosional unconformity and a scatter of cobbles and gravels (Figure 208-2).

In some test pits, especially in the site's northeast sector, there is a band of aeolian brown to light brown sands that lies between Strata 3 and 4. This less consolidated sediment, a local member of TS Unit IXc, was probably removed from most of the site area by the event that deposited the gravels of Stratum 3.

Strata 2 and 1 complete the sequence: a colluvial layer of poorly sorted silts, sands and pebbles and an historic sequence of unmixed lenses of colluvial sand, silt and pebbles. Stratum 2 also contains minor amounts (<3%) of Mazama glass and is a local representative of TS Unit XIV, a post-2500 BP colluvium.

Shell from Stratum 4 surface dates 4590+-110BP (Beta 5269); charcoal from an earth oven excavated into fill of a housepit cut from the Stratum 4 surface was used at around 2380+-120 BP (Beta 6562).

Cultural Stratigraphy.

After preliminary test excavations had been completed, we concluded that there was one occupation at this site, approximately 35x25m in extent (Figure 208-3). Vertical artifact frequencies showed artifact concentrations at the Stratum 2/3 and 2/4 boundaries in all areas of the site.

There were clearly two areas of high artifact density, one in the northwest, the other in the southwest part of the occupation area.

Shell was most common in the northeast concentration, bone and stone artifacts in the southwest. (Figure 208-3 shows artifact frequencies for these two areas.)

Test units scattered between these areas of high concentration continued to show a single occupation, although a few later artifacts turned up near the surface in the southeast locality. Artifacts included unifacial-edged cobble tools, leaf shaped and stemmed projectile points, fragments of large, ovate bifaces, microblades and several unusual, unifacially-retouched, blade-like tools. A single hearth also was observed, but contained only calcined bone.

Block excavations in the northwest and southeast localities revealed a large mussel shell and fire broken rock midden and a house, respectively. This house (Figure 208-4) was indicated by a 9.5mx3.5m ovate pit that had been excavated from the old soil surface 20-30cm into the cobbly hardpan below. The house floor was level, compact, clay hardpan. Embedded in the floor, we found numerous stemmed and leaf shaped projectile points, two large milling stones, a mano, microblades (N=3), cobble tools, quartzite knives and seven ornaments of clay and shell. Mussel shell and bone also were common on the floor.

A second shell and rock concentration overlies the house fill and probably represents use of the site after the housepit had been abandoned (Figure 208-5). A large feature occurs here as well and may be associated with shellfish processing.

The shell concentration in the northwest block underlies colluvial gravels of Stratum 3 (Figure 208-2). The house was cut 20-30cm from the Soil I surface and was subsequently filled with artifact-rich alluvial and colluvial pebbly sand (Figure 208-4). between this sand and the overlying FCR, shell and earth oven features is the aforementioned erosional unconformity, marked by a line of pebbles and scattered cobbles belonging to Stratum 3. Shell, rocks and stone tools were deposited atop this unconformity; the earth oven was cut through it.

We were not aware of this geologic situation until after radiocarbon dates had been obtained on shell from the house floor and charcoal from the earth oven. 2300 years separate the two features, even though they are often less than 30cm apart vertically. Reinspecting our projectile points, we learned that small, serrated and stemmed opal projectile points were common in and above the shell feature, but are absent on the house floor. They were absent outside the southeast block as well. Large leaf shaped and shouldered projectile points of jasper, basalt and chert occurred only on the house floor and in other site areas where the smaller points did not occur. Thus, we have two occupations: *Occupation* II distributed over the entire site area and Occupation I, confined to the southeast block and vicinity (Figure 208-6).

Because the two occupations are so close together stratigraphically, and because of rodent activity and Occupation I related digging, (e.g., the earth oven), we have not been able to observe distinct modes in vertical distributions of artifacts. Consequently, we separated the occupations by the systematic grouping of arbitrary levels. Artifacts from the shell feature and levels above were assigned to Occupation I, those from the house floor and 10cm above it are assigned to Occupation II. Artifacts from intervening levels are unassigned and have not been used in the following analyses. All other artifacts have been assigned to Occupation II. As a result of this process, there has been some mixing of assemblages, but we believe our efforts have minimized its effects.

Chronology.

Stratigraphy. Situated on the Soil I surface and apparently present while the soil formed, Occupation II should date between 400(and 5000 BP. Underlying a stratum of TS Unit XII, post-2500 BP colluvium, and an erosional event that removed the 4700-2500 BP TS Units XIc, Occupation I should be somewhat younger than 2500 years BP.

Artifact Chronology.

Occupation I contains small, shouldered and serrated points of Types 8 and 11, classic "Rabbit Island Stemmed" forms common to latest Period III and early Period IV. A 3000-2000 BP date is, therefore,

probable.

The six projectile points from Occupation II are all large, shouldered forms (Type 6), or large, leaf shaped (Type 5) projectile points of late Period I, early Period II. Microblades, a late Period I early Period II phenomenon elsewhere along the Columbia (e.g., Grabert 1968; Munsell 1968; Carlevato et al. 1982) also are present in this assemblage as are milling stones. All these characateristics place the assemblage, somewhere between 5400 and 4000 BP.

Radiocarbon. As we have stated above, Occupation I, house floor shells date 4590+-110 BP and Occupation II, earth oven charcoal dates 2380+-120 BP.

All chronological data are consistent with each other, placing Occupation II at around 4600 BP, Occupation I at 2400 BP.

Function.

Although assemblages are partially mixed, Occupations I and II are quite different in all functional dimensions.

Features. There are two shell features, one bone-filled hearth and a housepit in Occupation II. One shell feature, containing FCR but little bone or chipped stone, measures at least 3x2m over an irregular area of the northwest block. The other is an odd shaped remnant, eroded by the Stratum 3 wash event, located at 15S/18-20W. Its contents are similar, but with a higher flake and bone content. Several quartzite knives and an anvil stone occurred here. The hearth was a circular to ovoid area of burned earth and calcined mammal bone at least 50cm in diameter.

> Housepit 1. This housepit is the site's most thoroughly investigated feature. Excavating from Soil I into the surface of Stratum 5, the house's inhabitants cleared an oval area 9m long and 4m wide, with its long axis facing the Columbia River (Figure 208-4). Including the gently sloping wall of this pit, the house was probably 6x11m in size. Natural clays of Stratum 5 formed the hard-packed, artifact embedded floor. There are two milling stones embedded in the floor, both of which have irregular abrasion-type wear ("metates" as opposed to "hopper mortar base"). Along the house's north side, near the larger milling stone, were numerous large fragments of mammal longbone, mussel shell, salmon vertebrae and several tabular knives of quartzite. Fire broken rock was also common in this area. The milling stone was chipped around its edges, the chips still lying in place, indicate use of the stone as an anvil also. Several projectile points were scattered about the floor surface and three large, perforated disks of clay occurred in the southwest corner. We encountered no hearth; the stain shown in Figure 208-4 is the bottom of the Occupation I earth oven.

All Occupation I features are illustrated in Figure 208-5. In the north center of southeast block are two scatters of fire broken rock. Southeast from these is an amorphous mass of mussel shell adjacent to an earth oven. The latter feature is a basin shaped mass of rounded cobbles 120cm wide, by 130cm long and 35cm deep. Bits of shell and charcoal are interspersed among the stones. All features in this

activity area, FCR, shell and oven may represent a single activity; the cooking and processing of food.

Use-Wear. There were 34 tools in Occupation I and 93 in Occupation II (Table 208-2). These are among our largest and most diverse assemblages. Classes 3 and 4 are the most common tools (unifacially and bifacially chipped, convex edges). Class 19 (points) and 13 (chipped and crushed, concave edges) are also common items.

In Occupation II, Classes 3, 16, 19, and 4 are all abundant. Class 7 (hammer stones) is also common (note the presence of Class 17 [milling stones] in this occupation and 45OK207II only).

Common Sense Categories. Table 208-2 lists the artifacts found in 45OK208. Among the notable finds are a mano, two milling stones, and shell and clay beads. Three of the beads are 2.5-3cm diameter, 3-5m thick disks with biconical perforations. Two are incised, one with concentric designs, the other with a group of lines. There is also a spherical bead .9cm in diameter and two small dishes, one of shell, the other clay at about this same size. These clay beads are unique to the area.

Microblades found here, made from yellow and green chert (or metamorphosed mudstone) also make this site (Occupation II) unique to our Study Area. Their presence is especially unusual, since microblades are not ordinarily found in residential sites.

Fauna. Occupation II has a typical, low diversity, housepit assemblage (Table 208-2). Deer (55%, N=48; probably whitetail, considering their small size), salmonid fishes (24%, N=20) and turtle (8.5%, N=7) comprise all but a fraction of the non-endemic fauna in Occupation II. There are also one or two elements each from mountain sheep, elk, marmot, bull/king snake, non-salmonid fish, bird, and dog/coyote.

Deer (54%, N=9) and turtle (35%, N=6) comprise most of the Occupation I fauna, with porcupine and mountain sheep also present. This assemblage resembles Occupations 45DO394V and 45DO190/191-III.

Seasonality.

Only ethnographic analogy can be used to determine seasonality at this site. If people 4600 years BP (5400 years ago) behaved as their successors did, the older occupation at 45OK208 was inhabited in winter. We have no comparable information for Occupation I.

Lithic Utilization.

Here, both occupations are very much alike (Table 208-2). Most chipped stone is made from jasper/chalcedony/petrified wood (I=86, 5%; II=83, 2%); all other materials are present in frequencies of less than 7% in both assemblages. Totals are 690, Occupation I; 1809, Occupation II.

Occupation II is unique in its content of obsidian. Several small obsidian flakes were found in the house area (all but one in unassigned levels). All were nearly clear and black and one specimen has been identified by R. Lee Sappington as Quartz Mountain, Oregon obsidian (Appendix E).

Summary and Interpretation.

Site 45OK208 is situated at the toe of an alluvial fan just downstream from Fan Creek on the T2 level (RM 589). There are two occupations here. Occupation I, a limited activity logistic site with an earth oven and associated scatters of fire broken rock and mussel shell, covers one small (10x15m) corner of the site. It is 2400 years old. Occupation II is a housepit site, but the single house we encountered was unusual. A maximum of 11m long and 6m wide, this oval structure was built over a shallow (30cm) pit with sloping walls and a flat, clay floor. This is, to date, the oldest known pithouse structure in Washington, dating 4590+-110 radiocarbon years, about 5400 years old. Thus both in form and age, the house is unique. Another unique characteristic of the site is the presence of clay beads, three of which are large (2.5cm) perforated disks with incised designs.

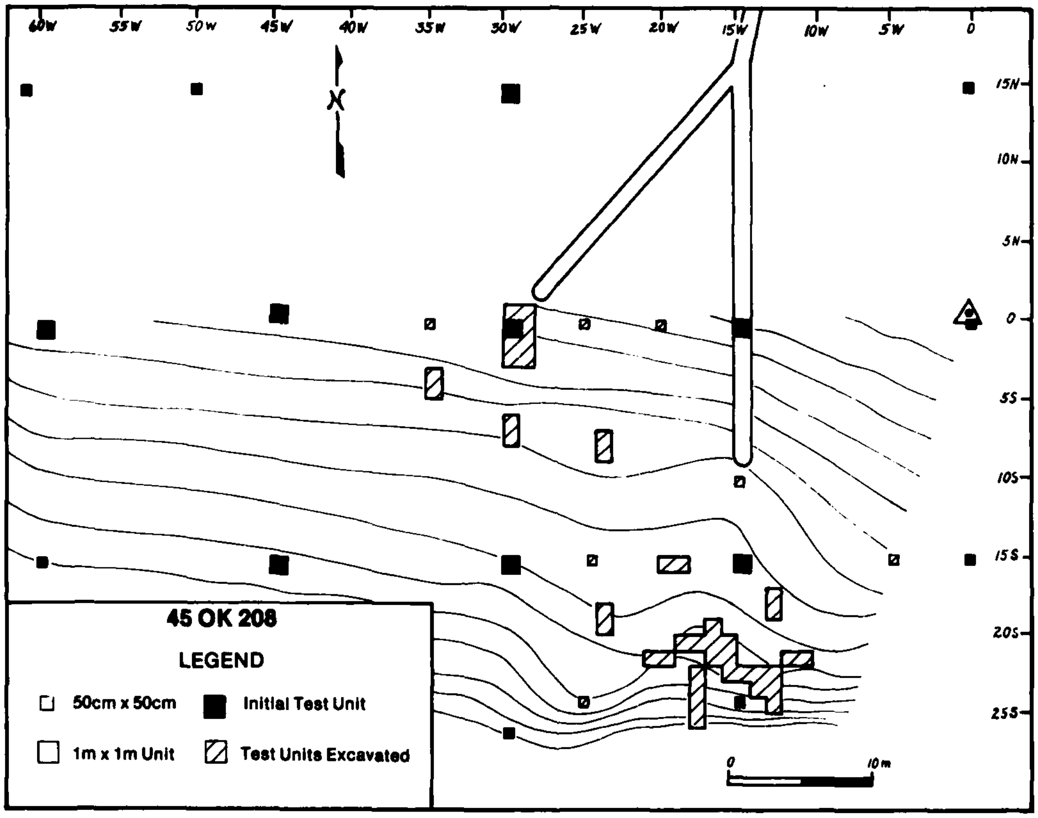

Figure 208-1. Topographic map of site 45OK208, showing the location of excavation units.

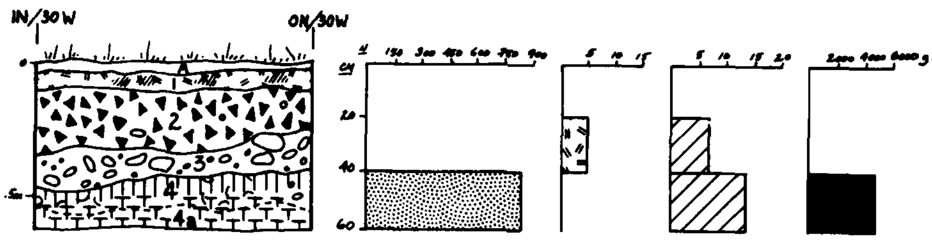

Figure 208-2. Example profile from 45OK208 compared with graphs of artifact frequency for that unit. See Table 208-1 for legend.

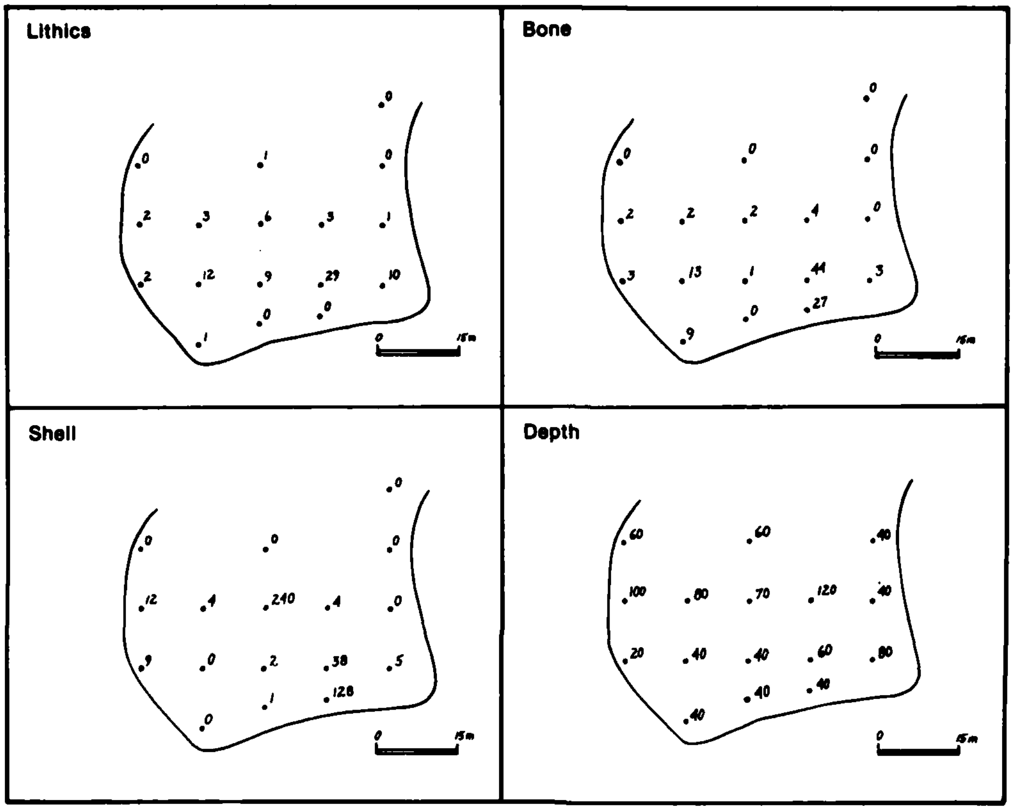

Figure 208-3. Distribution of artifacts at site 45OK208, figures are objects per .25 square meters.

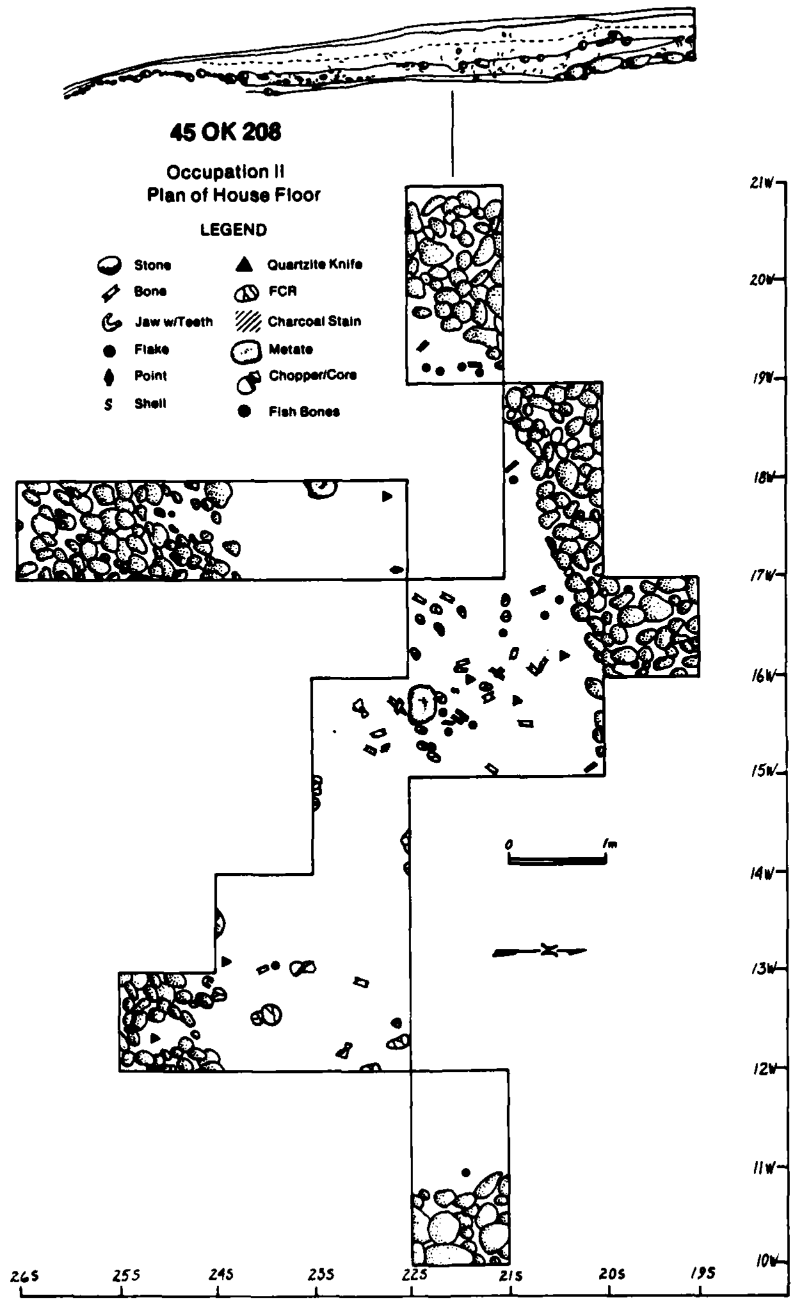

Figure 208-4. Plan map of House 1 at 45OK208, showing a profile from point A-A1.

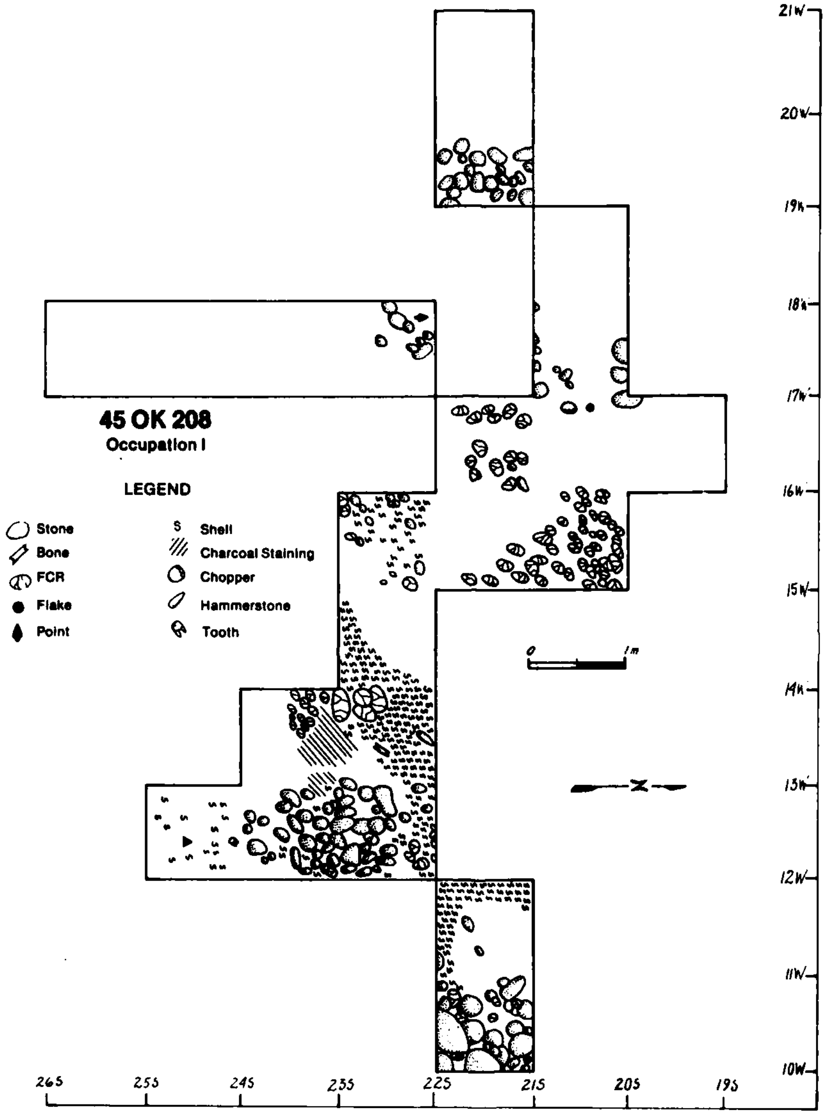

Figure 208-5. Plan map of Occupation I surface at 45OK208.

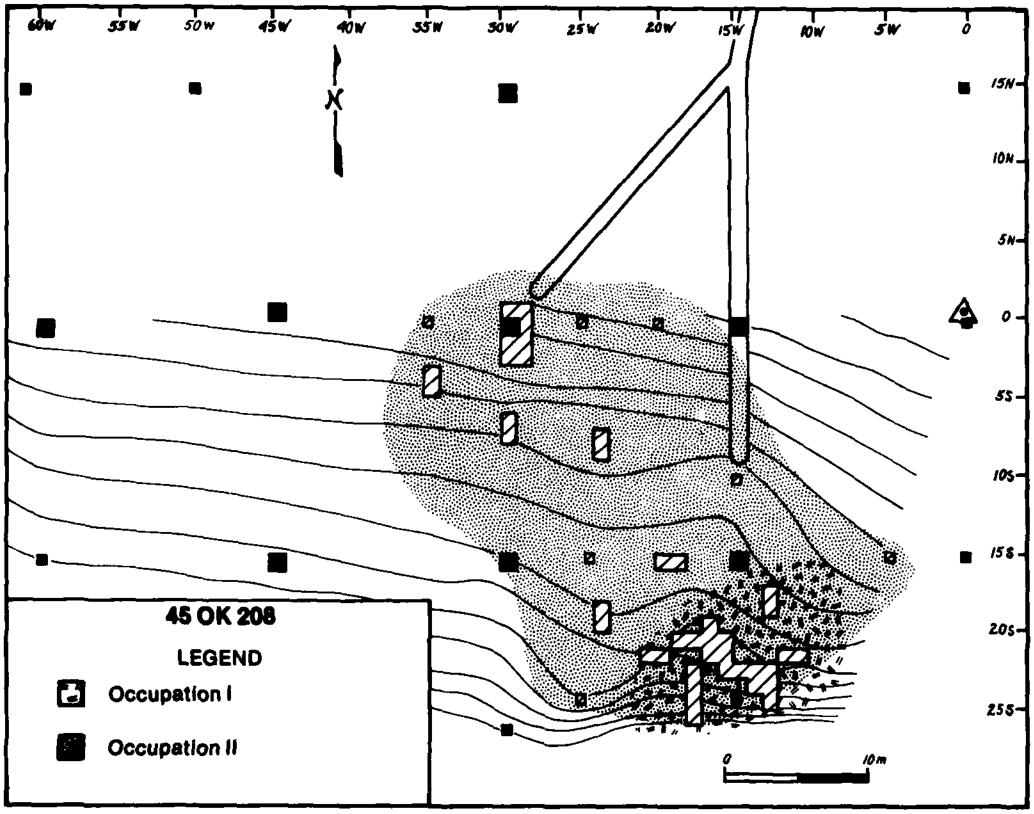

Figure 208-6. Distribution of Occupation I and II at 45OK208.

Figure Table 208-1. Description of geologic strata at Site 45OK208

Stratum	Description
1.	Brown fine to very-fine silty sand with some coarser particles. Laminated, with silt lenses present. Slightly hard, boundary gradual and wavy. Color: 10YR5/3.
2.	Brown to dark-brown fine silty sand with coarser particles to pea gravel size. Hard with abrupt, irregular boundary. Color: 10YR4/3-5/3. Occupation I occurs at the base of this stratum.
3.	Cobbles, pebbles, gravel with fine slightly silty sand. Very poorly sorted, most particles rounded. Slightly soft with clear, broken boundary. Rests unconformably on 4. Color: variable.
4a.	Dark grayish-brown very fine silty sand containing a few particles to coarse sand size, highly organic, hard to compact with diffuse, wavy boundary. Color: 10YR4/2. Ab horizon containing Occupation II.
4b.	Pale brown very fine silt with some sand, compact with clear, irregular boundary. Color: 10YR6/3. Buried B horizon.
5.	Angular to rounded cobbles in pale-brown silt matrix. Very hard, boundary unknown. Color: 10YR6/3.

TABLE 208-2.

SITE 45OK208

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Volume	3.50	23.40				3.20
TSU Position	Lower XII	Soil 1				
Radiocarbon Age	2270±50	4590±100				
Cultural Style Age	2500-1600	4000-5000				
Age Estimate	2250-2500	4500-4700				
FCR						
Count	475	907				351
Weight (kg.)	47.3	94.3				36.75
Mean	.099	.103				.104
Lithics						
Flakes	690	1809				450
Common sense categories	27	86				20
Utilized flake	4	18				
Unifac. ret. flk.		2				
Bifac. ret. flk.	2	4				
Amor. fl. object		1				
Biface	3	1				
Projectile point	5	10				
Microblade		3				
Drill	1	1				
Graver	1	1				
Scraper		1				
Spokeshave	1					
Core	1	8				
Tabular knife	7	17				
Hammerstone	1	8				
Chopper	1	2				
Millingstone		2				
Anvil		2				
Bead		5				
Projectile Point Types	5	5				
5		2				
6		3				
7						
8	2					
9						
10						
11						
12	3					
13						
14						
15						

SITE 45OK208

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class	34	93				
1		3				
2	1	2				
3	9	17				
4	8	16				
5	1	1				
6						
7	1	8				
8		5				
9	1					
10	2	3				
11	1	1				
12		1				
13	3	2				
14						
15	1	7				
16	1	15				
17		2				
18						
19	5	10				
Material	26	113				
Opal	597	1505				
Jasper/chert, chalcedony	13	66				
Basalt	49	103				
Quartzite	5	22				
Other						
Features						
Hearth		1				
Shell/FCR midden	1	2				
Pits						
Earth oven	1					
Housepit		1				
Form		Oval				
Diameter or L/W		6x11m				
No. Floors		1				

SITE 45OK208

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains	1075	2162				344
Unidentified Bone	1012	1893				
Unburned	929	1586				
ct.	196.85	942.3				
wt. (g.)						
Burned						
ct.	83	307				
wt. (g.)	62.8	129.82				
Identified Bone	63	269				
Unburned						
ct.	59	266				
wt. (g.)	82.5	647.7				
Burned						
ct.	4	3				
wt. (g.)	2.5	6.3				
Economic Fauna	17	84				
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis	1(1)	2(1)[1]				
Odocoilcus sp.	9(1)	48(4)				
Cervus canadensis		1(1)				
Antilocapra americana						
Carnivora						
Canis spp.		1(1)				
Lagomorpha						
Lepus spp.						
Rodentia						
Marmota flaviventris						
Ondatra zibethica						
Castor canadensis						
Erethizon dorsatum	1(1)					
Reptilia						
Chrysemys p.	6(1)	7(1)				
Crotalus						
Other snake		1				

1. NISP (MNI)

SITE 45OK208

SUMMARY OF CONTENTS

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae		20				
Cyprinid/ Catostomidae		2				
Aves		2				
Endemic Rodents						
Spermophilus	1(1)	2(1)				
Microtus						
Lagurus c.						
Peromyscus						
Perognathus						
Thomomys	11(3)	32(7)				
Mollusca	4584	9668				4948
Margaritifera falcata						

1. NISP (MNI)

45OK219

This site covers a 50m wide band along the upriver side of Corral Creek, on terrace level T3, approximately 900m downstream from River Mile 590 (Figure 219-1). It is located on the north bank of the Columbia River in T29N/R30E, SW 1/4, NE 1/4, SE 1/4 of Section 1 at an elevation of 329m, m.s.l. (1070'), approximately 43m (140') above the pre-dam river level. Vegetation is sagebrush, with a thin understory of grasses.

Rodent-exposed mussel shell, flakes and FCR were the only surface evidence of prehistoric occupancy at this site. The foundation of an historic wood frame house (visible on 1930 aerial photographs), a track road and sundry trash demonstrate a more recent occupancy. According to present-day land owner Barney Owsley, an old Colville woman lived on the site before he purchased it in the late 1930s.

Previous Investigations.

Seattle District archaeologists recorded this site in 1976 (Munsell and Salo 1977) and conducted small-scale test excavations in April, 1982. They excavated one 1x1m test pit and four shovel tests (of which we relocated only the test pit and shovel test 1, Figure 7A). In most of their tests, a single layer of high artifact density was encountered between 20 and 50cm depth. They noted a deposit at least 2m deep toward the back edge of the terrace; thinning toward the Columbia until artifacts could be seen on the exposed gravel surface.

Technique.

Ten 1x1m test pits and 14 50cm units were excavated on a 15m grid covering the entire site area. Profiles were drawn for all pits.

Stratigraphy.

This is our most complete stratigraphic sequence for either upper terrace level (T2, T3). Figure 219-2 presents a schematic of the most common strata; Figure 219-3 shows a cross-dated north-south series of pits. Table 219-1 presents a simplified description of strata.

We begin with Columbia River gravels of TS Unit II, overlain by Stratum 6, low-bar magnetite rich medium to coarse sands of TS Unit IIIa. Toward the back of the terrace (15N/0E in Figure 219-3) there are a few deposits of colluvial silt intermixed with this unit. Above the low bar sands, but only infrequently represented, are medium fine yellow to gray-brown sands of Stratum 4. Resembling the sands of Unit XIb on the T1 level, this stratum looks like wind-reworked upper bar alluvium (Unit VI). There is no Mazama tephra in this unit (<1%). Between Strata 4 and 6, or between 3 and 6 if Stratum 4 is absent, we see angular and subangular alluvial fan gravels in pits near Corral Creek (this unit is absent in the N-S cross-section).

Strata 1 and 2 are aeolian loess deposits. Stratum 2 is a pale brown silty fine sand; 1 is a very fine brown silty sand or sandy silt loess. Between Strata 2a and 2b is a layer rich in Mazama tephra (24%) that probably represents the primary ash fall (Stratum 3). Smaller amounts of tephra occur in Stratum 2a above the ash (6.67%) and in the contact zone between 2b and the ash layer (11.8%) other strata are tephra-free (<1%). Thus Stratum 2b predates 6700 BP. Stratum 2a is TS Unit VII; 2a is IX and Stratum 1 is XIc.

Cultural material is most abundant on the contact between Strata 1 and 2 where all features occur, and has been dated 4500+-80 and 4760+-120 BP.

AD-A147 658 HUMAN ADAPTATION ALONG THE COLUMBIA RIVER 4700 - 1600 BP A REPORT OF TEST..(U) CENTRAL WASHINGTON UNIV ELLENSBURG GRADUATE STUDIES AND RESEA.. 4/4

UNCLASSIFIED J C CHATTERS ET AL. JAN 84 RR-84-1 F/G 5/6 NL

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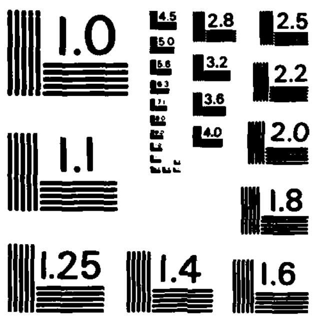


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Cultural Stratigraphy. Using vertical frequency graphs, we have established that at least three occupations occur at 45OK219. Occupation I is in the upper 20cm of Stratum 1; Occupation II is situated between Strata 1 and 2a; Occupation III is in Stratum 2b, below Mazama ash.

By far the most intensive occupation, Occupation II includes numerous mussel shell midden features (most near the south end of the site), at least one hearth and an apparent housepit (45S/15E).

Chronology.

Stratigraphy. Stratigraphically, Occupation I dates toward the end of the period during which TS Unit XI was formed either between 3500 and 2500 BP or after that period came to an end. Stratum II lies between Unit IX and Unit XI, and thus corresponds to the age of Soil 1 or 5000-4000 BP. Lying below Mazama ash in loess deposits probably formed after 8000 BP, Occupation III probably dates to between 6700 and 8000 years BP.

Artifact Chronology. There are no temporally diagnostic artifacts from Occupation III, only two from Occupation II and one from Occupation I.

All are projectile points. Those from Occupation II are the base of a straight-based lanceolate projectile point of green chert and a convex based, serrated lanceolate of opal. Both are Type 5 and date the assemblage to Period I or early Period II (before 4000 BP).

The corner notched (corner removed) projectile point from Occupation I is Type 13, from Period III, 3500-2500 BP.

Radiocarbon Dating. We obtained two dates, both on shell from a feature and house floor in Occupation II. The house floor date is 4590+-100 BP (Beta 5269) and the shell feature was 4760+-120 BP (Beta 6265). Both were corrected for isotopic selectivity.

Function.

Features. Several shell midden concentrations (at least 4, not all were recorded as features), one hearth and an apparent pithouse are attributable to Occupation II.

The pithouse is distinguished by a dense concentration of mussel shell and broken (but not pulverized) bone at 170cm below surface, overlain by Stratum 1 deposits. Since there is no evidence here of a stream-cut channel, and since Occupation II is usually within 50cm of the surface, this feature probably represents the floor of a housepit dug 1.2m into the terrace. The associated shell feature is the only apparent floor deposit.

Use-Wear. There are very few tools from our test excavations, 24 in all (Table 219-2). In spite of this low frequency, each occupation exhibits the same pattern: Classes 3, 1 and 19 are either the only tools or the most common tools present. Class 3 is always at least twice as common as either Class 1 or 19, which are equal. Activities indicated by these tools are light scraping with concave and convex edges, and the use of projectile points in hunting or the on-site manufacture or repair of projectile points.

The pattern is unique to this site and its consistency among all three occupations is strange. Considering the elapsed time (up to 5500 years) between occupations some change in site use is likely. Small sample sizes leave ample room for sampling error and usually result in

marked differences between assemblages.

Either the pattern is real, and connotates a limited use of this stream-side locality throughout the prehistoric record (Period I through III) or one, limited assemblage (Occupation II) dominates the others through mixing. The latter explanation is less likely here than it was for 45OK207 or 45OK208, where assemblages were not separated stratigraphically. At 45OK219, assemblages are distinct both stratigraphically and distributionally. The pattern may well be real. If so, why is Occupation II, with its probable pithouse, so distinct from other sites of that age and kind?

Common Sense Tool Categories. In Occupation I are 1 projectile point, 2 utilized flakes, a bifacially retouched flake and a tabular knife (N=5). Occupation II includes 2 projectile points, 3 utilized flakes, and one each, scraper, uniface retouched flake, spokeshave and awl categories (N=9). The six items in Occupation III are distributed among an equal number of categories: projectile point (fragmentary), bifacially retouched flake, spokeshave, tabular knife, bone awl and antler wedge. There is little similarity here.

Fauna. In this dimension, like features, we again see some differences among the occupations. Occupation II, (N=69 after removing endemic rodents) looks like a proper pithouse assemblage, with 65% (N=47) salmonid fish, 22% (N=13) deer and a smattering of other species (mountain sheep, beaver, turtle, bird, dog/coyote and hare). The number of salmonid elements is deceptive; the majority came from what appears to have been a single fish carcass in grid unit 45S/0W.

Occupation I is all deer (N=7); only endemic rodents occur in Occupation III.

Seasonality. No data are available beyond ethnographic analogy, which would identify Occupation II as a winter/year-round base camp.

Lithic Material Use.

Occupation I lithics (N=75) are primarily jasper/chalcedony/petrified wood (62.7%, N=47) and opal (18.7%, N=14) with other materials present in frequencies below 8%. Opal is more common among the 172 stone artifacts in Occupation II (30.8%, N=53) with jasper/chalcedony/petrified wood still most abundant (51.7%, N=89). Again, all other materials are under 8% of the total. There are only 16 lithics from Occupation III, most (68.8%, N=11) of which are jasper/chalcedony/petrified wood.

Summary and Interpretation.

45OK219 is a three-occupation site representing cultural Periods I, II and III. Occupations I and III collections contain too few artifacts and too little feature data for us to place them securely in the settlement patterns of their respective periods. Occupation II, although also sparse, is apparently a housepit occupation similar to 45OK207 and 45OK208. However, there is an unusual pattern of use-wear (light scraping tools and projectile points). This occupation may have had multiple uses, with a winter/base camp use being a minor component and a highly specialized, field camp use the more important. Based on lithics only, Occupation III also looks like a field camp. Lithics and fauna argue the same for Occupation I, which looks very much like the ephemeral hunting camp occupations of 45DO394.

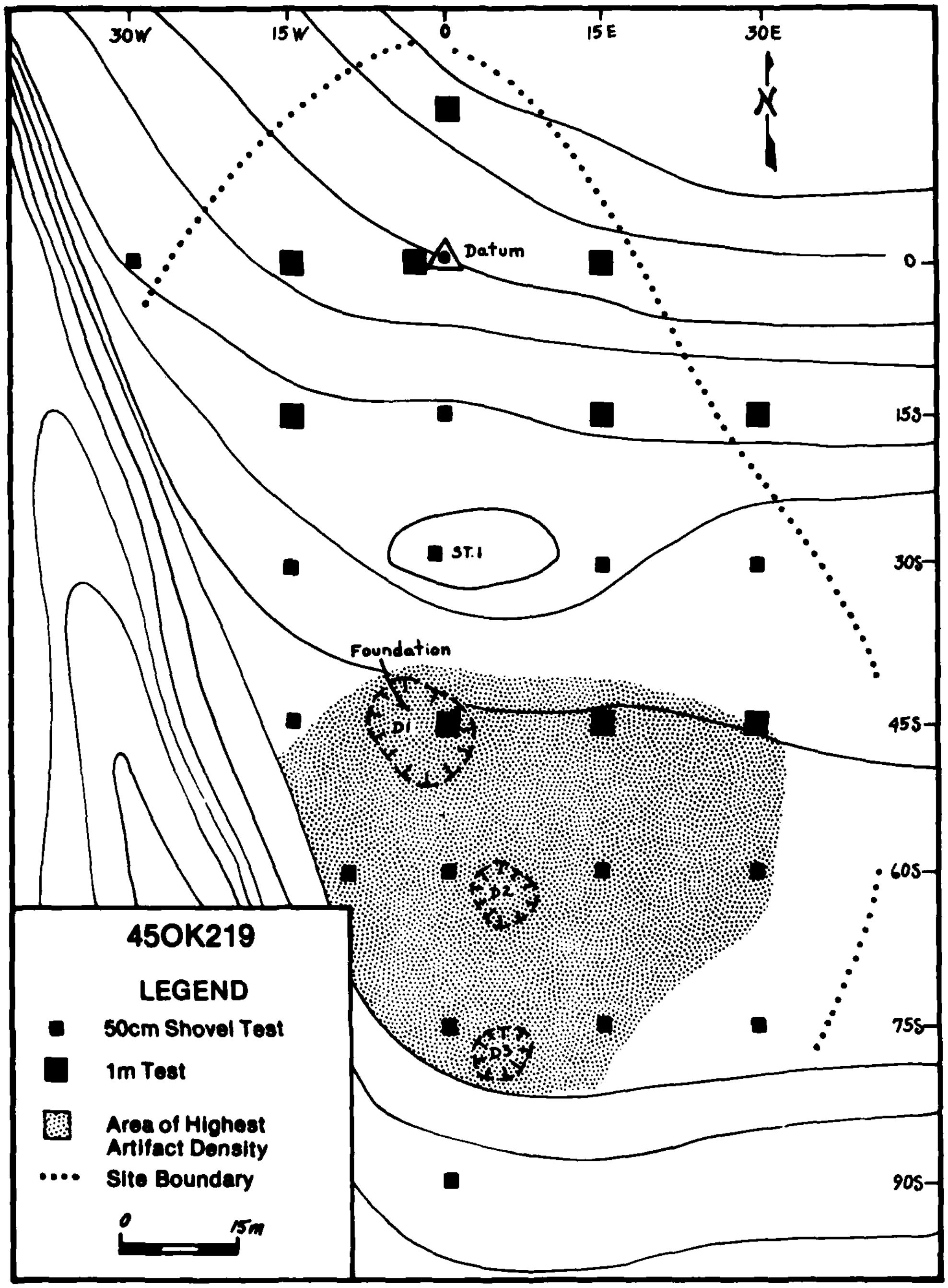


Figure 219-1. Contour map of site 45OK219 showing location of surface depressions, test pits and site boundaries.

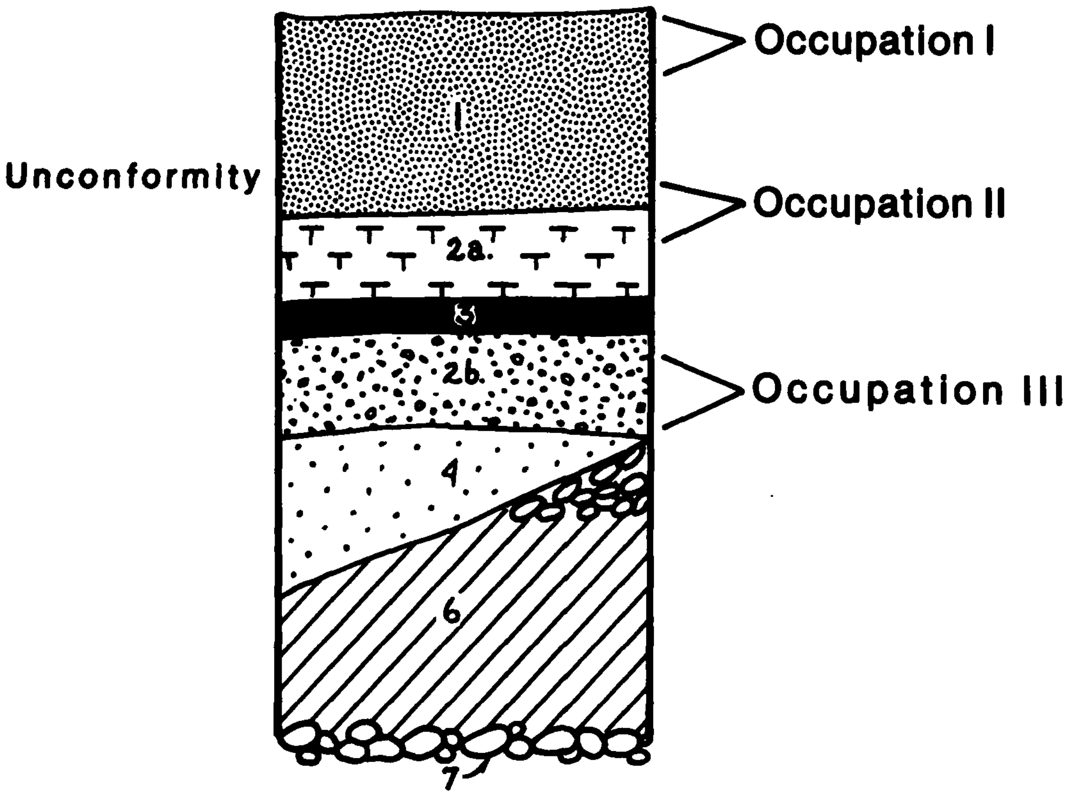


Figure 219-2. Schematic profile of deposits at 45OK219.

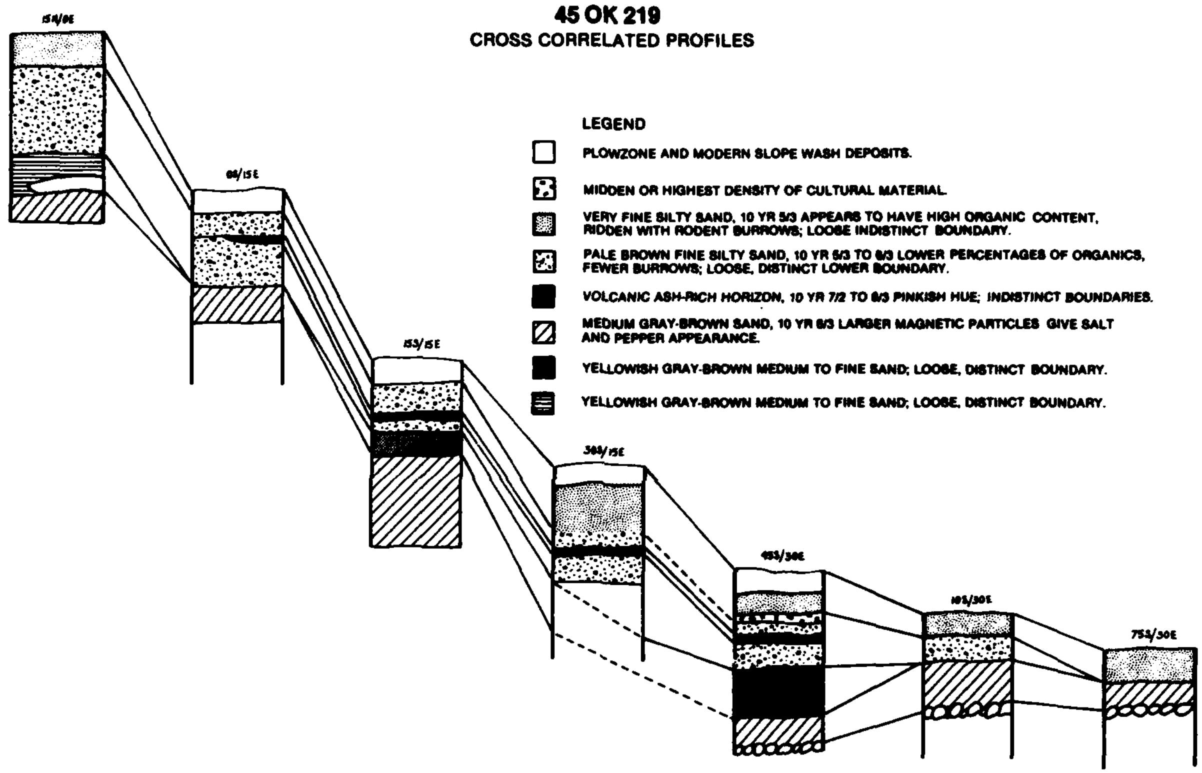


Figure 219-3. Cross-dated profiles from a N-S line of test pits at 45OK219.

Table 219-1. Description of Geologic Strata at Site 45OK219.

Stratum	Description
1.	Brown very fine silty sand with some coarse particles. Slightly firm, massive, with gradual irregular boundary. Color: 10YR5/3. Occupation I occurs near the surface of this stratum, Occupation II at the bottom.
2.	Pale brown, fine silty sand with some pebbles and coarse sand, slightly firm, boundary gradual and smooth. Color: 10YR5/3 to 6/3. Tephra present. Occupation III is in Stratum 2b, below Stratum 3.
3.	Pale grayish brown silty, ashy fine sand; Mazama tephra. Slightly firm to firm, boundary clear to gradual and broken. Color 10YR7/2.
4.	Yellow-brown to pale brown silty fine to medium sand with a few coarser particles. Slightly soft, boundary wavy and gradual. Color: 10YR5/4 to 10YR6/2.
5.	Alluvial fan gravels and cobbles.
6.	"Salt and pepper" medium to fine sand, slightly soft to soft, boundary gradual to abrupt, Color: variable.
7.	Gravels and cobbles, slightly loose, boundary unknown.

TABLE 219-2.

SITE 45OK219

SUMMARY OF CONTENTS

			OCCUPATION			
Category	**I**	**II**	**III**	**IV**	**V**	**Unassigned**
Volume	3.0	11.2	1.40			12.10
TSU Position	Upper XIc	Basal XIc	VII			
Radiocarbon Age	---	$\bar{X}4630\pm100$	---			
Cultural Style Age	2500-3500	>4500	---			
Age Estimate	2500-3500	4500-4700	>6700			
FCR						
Count	95	266	6			106
Weight (kg.)	6.3	14.6	2.8			1274
Mean	.006	.054	.466			.113
Lithics						
Flakes	75	172	16			114
Common sense categories	4	8	6			17
Utilized flake	2	3	2			
Unifacial ret. flk.		1				
Bifacial ret. flk.	1					
Biface			1			
Projectile point		2				
Scraper		1				
Spokeshave		1				
Tabular knife	1		2			
Projectile Point Types	1	2				
5		2				
6						
7						
8						
9						
10						
11						
12						
13	1					
14						
15						

SITE 45OK219

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Lithics						
Use Wear Class	8	12				
1	1	2	1			
2	6	5	2			
3		1				
4		1				
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16		1				
17						
18						
19	1	2				
Material						
Opal	14	53	2			
Jasper/chert, chalcedony	47	89	11			
Basalt	6	13	1			
Quartzite	3	4	2			
Other	5	13				
Features						
Hearth						
Shell/FCR midden						
Pits						
Earth oven						
Housepit		1				
Form		?				
Diameter or L/W		?				
No. Floors		1				

SITE 45OK219

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains	339	1503	35			157
Unidentified Bone	325	1408	28			147
Unburned	302					
ct.		1332				
wt. (g.)	103.88	308.55	7.7			
Burned	23					
ct.		76	8			
wt. (g.)	5.19	22.94	2.0			
Identified Bone	14	95	7			
Unburned						
ct.	14	95	7			
wt. (g.)	212.03	184.76	.2			
Burned						
ct.						
wt. (g.)						
Economic Fauna	7	69	0			
Artiodactyla						
Bos taurus						
Ovis aries						
Bison						
Ovis canadensis		1(1)				
Odocoilcus sp.	7(1)	13(1)				
Cervus canadensis						
Antilocapra americana						
Carnivora						
Canis spp.		1(1)				
Lagomorpha						
Lepus spp.		4(2)				
Rodentia						
Marmota flaviventris						
Ondatra zibethica						
Castor canadensis		1(1)				
Erethizon dorsatum						
Reptilia						
Chrysemys p.		1(1)				
Crotalus						
Other snake						

1. NISP (MNI)

SITE 45OK219

SUMMARY OF CONTENTS

OCCUPATION

Category	I	II	III	IV	V	Unassigned
Faunal Remains (cont.)						
Pisces						
Salmonidae		47				
Cyprinid/ Catostomidae						
Aves		1				
Endemic Rodents		3	2			
Spermophilus						
Microtus						
Lagurus c.						
Peromyscus						
Perognathus		2(1)	1(1)			
Thomomys		1(1)	1(1)			
Mollusca	79	2112	35			146
Margaritifera falcata						

1. NISP (MNI)

Appendix B

FINAL REPORT ON MAGNETIC SURVEYING

SITES 45OK207, 45DO189, 45DO190

by

Rob Huggins

Spectrum Geophysics
2250 Lipscomb Street
Fort Worth, Texas
76110

for

Central Washington University Archaeological Project

and

United States Army Corps of Engineers
Seattle District

May 10, 1983
(Revised June 1, 1983)

NONCIRCULATED: Not circulated, available on request from: Seattle District Corps of Engineers, P.O. Box C3755, Seattle, WA 98124.

Appendix C

VOLCANIC ASH STUDIES

(1) Tephra identification by Charles R. Knowles.

(2) Volcanic Tephra content analysis by Bruce Cochran.

C1

RECEIVED

CWAS

April 11, 1983

Jim Chatters
Central Washington Archeological Survey
Central Washington University
Ellensburg, Washington 98926

Dear Jim:

I got the two samples from Bruce Cochran that you recommended, therefore, the following samples were used with my abbreviated numbers for notation. The sample 450K165-5A that I got from Bruce Cochran is called sample 5A. Sample 450K165-IX layer is referred to as sample 9, 450K165-VIII layer is referred to as sample 8 and from Bruce Cochran 450K219 is referred to as sample 219.

I will refer to several papers that give the operational procedure used in this ash analysis. These are the papers by Smith, Okazaki and myself which appeared in Quaternary Research in 1977 and the paper in Northwest Science by the same authors. Also refer to the paper by Smith and Westgate published in 1969 in Earth and Planetary Science Letters.

The standard used in the procedure was an obsidian from the Smith and Westgate's paper. In each sample at least 20 different glass shards were analysed for the three elements, calcium, Potassium and iron. I will not go into much detail except to state that aluminium and magnesium were used to monitor each shard to assure that I was hitting only glass and not a mafic or feldspar grain. There is an enclosed table listing the quantative analysis for calcium, potassium and iron for all four samples, also giving the ratio of calcium to potassium, potassium to iron and the normalized data used to plot calcium, potassium and iron in the

manner used in the paper by Smith, Okazaki and Knowles for Glacier Peak as well as the other papers I mentioned. I am sending you a reprint of the Glacier Peak paper to serve as a guide.

I have plotted the four points for the four ash samples on an accompanying triangular diagram. This diagram is using the normalized data in the table and shows good grouping of the three samples 450K165 with a slight spread of the sample 450K219. I think this is obvious in the diagram.

The conclusion is that all four points plot in the Mazama region. The only confusion would be that of St Helens set W. The glass shards appear quite different than the set W in that the Mazama ash has much thicker walls and the phenocrysts are a different assemblage. From this plotting and the data you can conclude that your samples are Mazama.

I am enclosing the original data for your use. I would recommend that should you have any questions you give me a call. The numbers came out very good with very slight variation between the samples. I noted that the sample 219 was slightly less in calcium than the other samples and that was the only change but it still plots in the Mazama region.

I am enclosing a bill for my services for the amount we discussed of $50.00 for the microprobe analysis and $5.00 for the sample preparation which comes to a total of $220.00. The invoice number is noted and I would appreciate if you could send this thru the proper channels for payment. If you have any questions at all on the data please call.

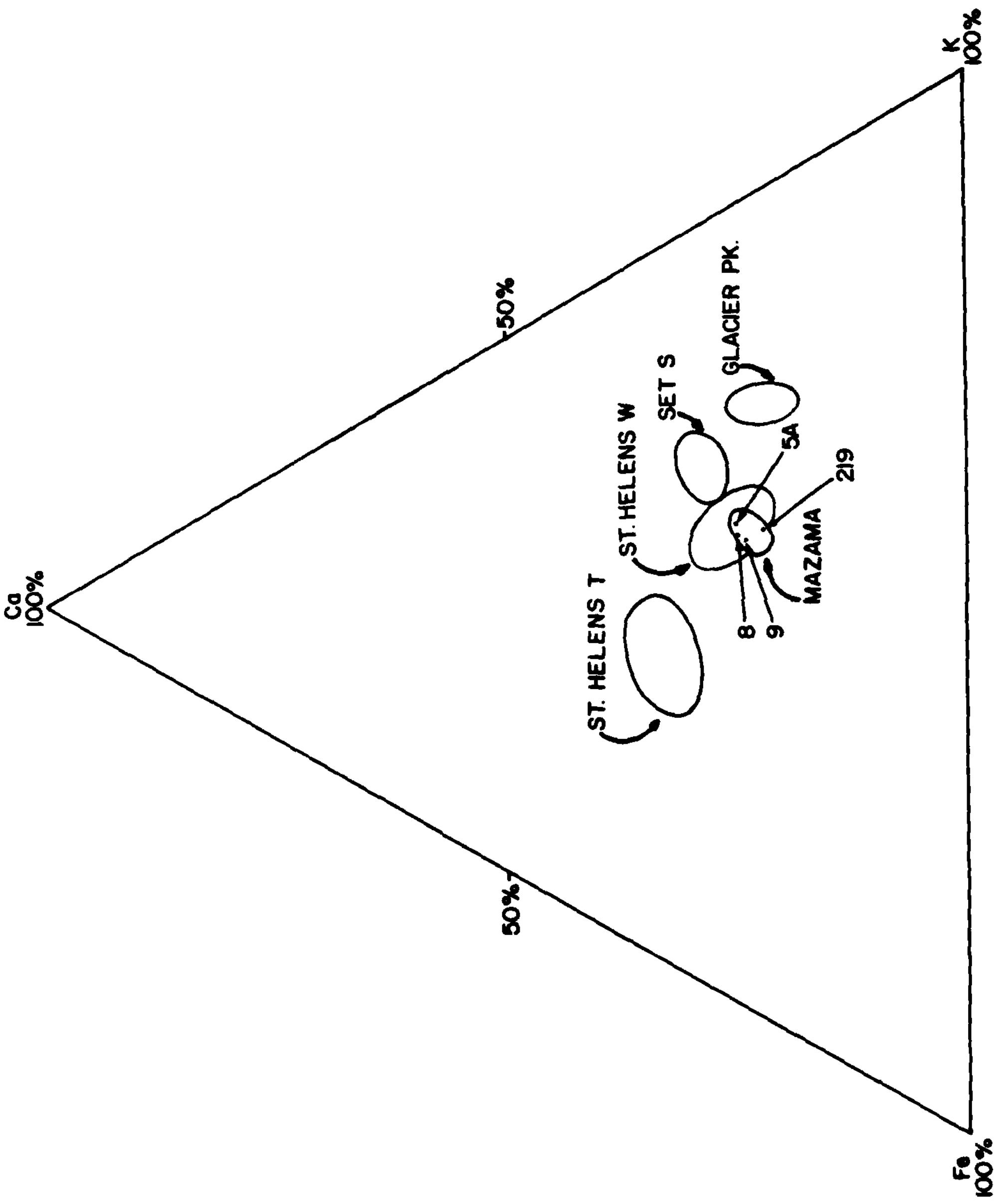
Yours truly,

Charles R. Knowles

Charles R. Knowles

Site	Sample	Elements: K	Elements: Ca	Elements: Fe	Element Ratios: K:Ca	Element Ratios: K:Fe	Element Ratios: Σ=100% Ca:Fe:K
450K165	5A	2.19%	1.23%	1.49%	1.8	1.5	25:30:40
450K165	IX Layer	2.13%	1.14%	1.56%	1.9	1.4	24:32:44
450K165	VIII Layer	2.13%	1 20%	1.48%	1.8	1.4	25:31:44
450K219	3	2.20%	1.08%	1.53%	2.0	1.4	22:32:46

Standard used was obsidian from Smith and Westgate 1969 (EP/S11-6)


K
100%
Ca
100%
Fe
100%
50%
50%
GLACIER PK.
SET S
ST. HELENS W
ST. HELENS
ST. HELENS T
5A
219
MAZAMA
8
9

Volcanic Tephra Content Analysis, Sites 45DO189, 45OK165, 45OK207, 45OK208, and 45OK219

By Bruce D. Cochran[1]

Primary tephra beds, which have been petrographically and petrochemically (electron microprobe) characterized and identified and consequently radiocarbon dated near the source vent, have been long used by archaeologists, paleontologists, stratigraphers, and geologists as time-stratigraphic marker horizons to date and correlate sedimentary sequences throughout the Pacific Northwest. Secondary volcanic ash deposits and inclusion of reworked volcanic glasses into deposits postdating a particular eruption and ashfall can be used to refine a relative geochronology only if the provenience of the glasses can be determined. When radiocarbon datable materials are lacking in sedimentary sequences containing cultural debris the utility of refining the relative chronology is critical, especially with respect to short-term erosional and depositional events which may be locally spurious but nonetheless important.

The Mount Mazama eruption 6,700 years ago (Powers and Wilcox 1964; Wilcox 1965; Fryxell 1965; Mack and others 1979) was one of the most extensive and voluminous ashfalls ejected during the Holocene in the Pacific Northwest. Deposits postdating this ashfall usually contain abundant volcanic glasses clearly originating from this ashfall (Cochran and Leonhardy 1982; Cochran 1982 in press). Conversely, deposits predating the Mazama ashfall obviously lack Mazama volcanic glasses. They do contain, however, other volcanic glasses from various sources including Mount St. Helens, (sets C, K, M, S, and J), Glacier Peak (principally layers G and B) and various Miocene basaltic fissure vents which are scattered throughout the Columbia Plateau.

Careful petrographic examination noting such details as glass type or morphology (vesicular, platy, or tubular), degree of rounding and sphericity, and refractive indices, is necessary to distinguish between Mount Mazama volcanic glasses and other volcanic glasses. Fortunately, Mazama glasses are distinctive having unique characteristics which allow them to be separated from other volcanic glasses. Refractive indices of Mount Mazama glass shards and pumice fragments commonly display a range between 1.504 and 1.512 with most glasses clustering between 1.506 and 1.508. Morphological characteristics of the glass vary from vesicular, platy to tubular types. Most other volcanic glasses ejected from other volcanoes during the Holocene usually consist of vesicular glass types displaying a lower refractive index usually ranging between 1.496 and 1.502. Therefore, petrographic distinctions between Mount Mazama and other volcanic glasses can be determined. Miocene basaltic glasses are often incorporated into Holocene sediments especially if a fissure-vent is nearby. These glasses are easily distinguished from volcanic glasses originating from Cascade volcanoes because they have: 1) a very high refractive index--greater than 1.512, 2) most glasses are partially devitrified--

reverted to a crystalline state or contain an unusually high frequency of microphenocrysts, 3) most glasses exhibit low sphericity, a high degree of angularity, and are blocky and elongated with ridges and spines.

Petrographic analyses of sediment samples from depositional units at archaeological sites was done to determine glass content, type (morphology-vesicular, platy, or tubular), and refractive indices. These analyses help provide the base-line information required to establish a relative chronology of cultural and geologic events. Thirty-four samples were analyzed (three from 45DO189, eight each from 45OK165, 207 and 208 and seven from 45OK219 (see Miss and Cochran, 1982, Appendix C for details on the cleaning and seiving procedures). Between 1000 and 3700 grains were identified from each sample to assess the percentage of Mazama and non-Mazama glass shards in the matrix. Results are presented in the following table.

Possible sources of contamination of Mazama glasses into pre-Mazama sediment include: 1) collection of bioturbated sediments, 2) contamination by the collector, and 3) natural infiltration through large pores and along natural vertical and horizontal parting planes or ped surfaces which open and close during soil formation. Bioturbation and "collector-turbation" clearly present the greatest problems. Therefore, careful field collection was done to minimize contamination.

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[1] Mr. Cochran did not submit a report, but referred us to Christian Miss and Bruce D. Cochran, 1982: Archaeological evaluations of the Riparia (45WT1) and Ash Cave (45WW61) sites on the Lower Snake River. Project Report No. 4 Laboratory of Archaeology and History, Washington State University. This statement is paraphrased from pp. 78-80 of that report.

Site	Sample	Stratum	Mz Glass*	Phenocrysts	Non-Mz Glass	Non-Glass	Total	% Non Mz	% Mz
45DO189	50-60	1b	-	-	-	1000	1000	-	-
	73-82	1b	-	-	-	1000	1000	-	-
	100-110	3	-	-	-	1000	1000	-	-
45OK165	2	Upper 1	-	-	-	1000	1000	-	-
	3	Mid 1	24	-	-	1946	1970	-	1.22
	4	Lower 1	26	-	-	2306	2332	-	1.11
	5	3	308	-	4	1086	1398	0.28	22.03
	5a	7	888	52	4	944	1888	0.21	47.03
	6	Upper 6	-	-	-	1000	1000	-	-
	7	Mid/Lower 6	-	-	-	1000	1000	-	-
	8	Lowest 6	-	-	-	1000	1000	-	-
45OK207	1	7	12	-	18	2226	2256	0.80	0.53
	2	Mid 4	18	-	2	2164	2184	0.90	0.82
	3	Upper 4	45	-	12	2538	2595	0.46	1.73
	4	3	52	-	-	3632	3684	-	1.41
	5	3	68	-	-	2740	2808	-	2.42
	6	Lower 2	150	-	12	2730	2792	0.41	5.19
	7	Upper 2	96	-	15	2742	2853	0.53	3.36
	8	1	112	-	44	2524	2680	1.64	4.18
45OK208	1	Between 4 & 5 ◆	30	-	2	1900	2022	0.10	1.48
	2	Between 4 & 5	-	-	-	1000	1000	-	-
	3	4b	34	-	2	1946	1982	0.10	1.72
	4	4a	16	-	-	2406	2422	-	0.66
	5	Lower 2	30	-	2	2130	2182	0.10	1.39
	6	Middle 2	-	-	-	1000	1000	-	-
	7	Upper 2	42	-	9	2220	2271	0.40	1.85
	8	1	54	-	4	1862	1920	0.21	2.81
45OK219	3	2a	129	-	24	1782	1935	1.24	6.67
	4	3	411	-	15	1269	1695	0 88	24.25
	5	2b	174	-	-	1299	1473	-	11.81
	6	4	28	-	-	1622	1650	1	1.70
	7	Upper 6	10	-	-	1330	1340	-	0.75
	8	Middle 6	-	-	-	1000	1000	-	-
	10	Lower 6	-	-	-	1000	1000	-	-

* Mz refers to Mount Mazama, source of the tephra from which the glass derives

◆ Samples 1 and 2, 45OK209, come from a clastic mudflow layer represented in the site only as clays among the large river cobbles of Stratum 5.

Appendix D

LITHIC ANALYSIS INPUT CODES AND DATA

prepared by:

Gregory C. Cleveland
and
John Benson

NONCIRCULATED: Not circulated, available on request from: Seattle District Corps of Engineers, P.O. Box C3755, Seattle, WA 98124

Field #7 Level Number
(Columns 14, 15)

CODE 1-50	10cm levels	CODE 51-59	20cm levels
1 =	0 - 10	51 =	0 - 20
2 =	10 - 20	52 =	20 - 40
3 =	20 - 30	53 =	40 - 60
4 =	30 - 40	54 =	60 - 80
5 =	40 - 50	55 =	80 - 100
6 =	50 - 60	56 =	100 - 120
7 =	60 - 70	57 =	120 - 140
8 =	70 - 80	58 =	140 - 160
9 =	80 - 90	59 =	160 - 180
10 =	90 - 100	60 =	180 - 200
11 =	100 - 110	61 =	200 - 220
12 =	110 - 120	62 =	220 - 240
13 =	120 - 130	63 =	240 - 260
14 =	130 - 140	64 =	260 - 280
15 =	140 - 150	65 =	280 - 300
16 =	150 - 160	66 =	300 - 320
17=	160 - 170	67 =	230 - 340
18 =	170 - 180		
19 =	180 - 190		
20 =	190 - 200		
21 =	200 - 210		
22 =	210 - 220		
23 =	220 - 230		
24 =	230 - 240		
25 =	240 - 250		
26 =	250 - 260		
27 =	260 - 270		
28 =	270 - 280		
29 =	280 - 290		
30 =	290 - 300		

Field #11 Raw Material
(Columns 23, 24)

CODE
01 - 11

01 Obsidian

02 Opal/Opaline

03 Jaspar/Petrified Wood/Chalcedony Cryptocrystalline

04 Basalt

05 Quartzite

06 Quartzofeldspathic Schist

07 Nephrite/Steatite

08 Mudstone/Siltstone (argillite)

09 Granodiorite/Granite

10 Indeterminate

11 Other

12 Listed Separately

Field #13 Secondary Modification (Manufacture)
(Column 27)

CODE
1 - 5

0 None

1 Unifacial or unimarginal retouch (removal of excess material in the shaping process either by percussion or pressure flaking from one face, >2 negative bulbs.

2 Bifacial or bimarginal retouch (removal of excess material in the shaping process either by percussion or pressure flaking from both faces of an edge).

3 Pecking, grinding, abrading.

4 1 and 2.

5 1, 2, and 3.

Field #12 Reduction States
(Columns 25, 26)

CODE		
01 - 08		
00	Other	
01	Core	(Evidence of platform preparation and >1 negative bulbs of precussion).
02	Chonchoidal Flake	(Conchoidal nonlinear or nonblade-like flake; has >1 flake attributes).
03	Linear or Blade-Like Flake	(Exhibits blade-like characteristics; see Tixier (1974), has >1 flake attributes).
04	Bifacial Thinning Flake	(A detritus detached from a biface in the process of shaping or thinning that retains a curved longitudinal profile with the bifacial striking platform displaying >2 negative bulbs of precussion on each face).
05	Tabular Flake	(Flake or detritus that has striking platform and at least one planar surface resulting from separation along inherent cleavage of stone).
06	Chunk Shatter	(A detritus with at least one flake attribute but also cleavage along craze lines, weathering planes or incipient weakness popularly known as "gobline").
07	Bipolar Core	(A core, often a cobble, displaying 180° opposed striking platforms, negative bulbs of percussion and crushing).
08	Bipolar Flakes	(A flake or detritus that exhibits 180° opposed striking platform remnants, positive bulbs of percussion and crushing).
09	Core Reduction Flake	
10	Biface	

Field #23 K (Kind of Wear)
(Column 55)

CODE		
1 - 7		
1	Chipping	Three or more hertzian cones within less than 5mm of one another, less than 30% of which have hinge or step terminations.
2	Abrading	Three or more parallel striations less than 1mm apart and greater than 4mm long.
3	Polishing	A high sheen confined to only a portion of an object. Sheen on all artifact edges or an entire surface is considered to be a natural condition.
4	Crushing	Small, irregular fragments removed over 5mm of edge or 1 square cm of surface or more.
5	Chipping and Polishing	Combination of 1 and 3.
6	Chipping and Abrading	Combination of 1 and 2.
7	Abrading and Polishing	Combination of 2 and 3.
8	Crushing and Chipping	Combination of 1 and 4.

Field #24 Location of Wear
(Column 56)

CODE		
1 - 3		
1	Edge	(Wear on the intersection of two planes).
2	Point	(Wear on intersection of three or more planes, continuing onto adjacent edges).
3		(Wear on a flat surface).
4		(None).
5		(Edge and point).

Field #25 Shape of Worn Area
(Column 57)

CODE		
1 - 4		
0	No wear	
1	Concave	(Indentation of edge or surface with a width greater than twice the depth)
2	Notch/Pit	(Indentation of edge or surface with width less than twice the depth).
3	Convex	(Edge or surface inscribes are of zero or more degrees, includes flat surface and straight line).
4	None	
5	Point	

Field #26 Faciality

CODE		
1 - 4		
1	Unifacial or unimarginal	(Wear on one surface or one side of edge only).
2	Bifacial	(Wear is coincident on two sides of edge or two opposing surfaces).
3	Alternate	(Wear is on alternate sides of parallel or intersecting edges).

Field #27 A (Angle)
(Column 59)

CODE	
1, 2	
1	$< 60°$
2	$> 60°$
3	N/A

Field #14 Cortex
(Column 28)

CODE

1 - 4

0 None (No original weathered surface visible)

1 Partial (Some original weathered surface visible)

2 Complete (All original weathered surface visible)

3 (Not applicable)

Field #15 Heat

CODE

1 and 2

0 No evidence

1 Crazing, pot lidding, or possible color and texture change

(Crazing is minute fracture lines caused by differential cooling of the stone, pot lidding is the catastrophic sloughing of conchoidal or round flakes probably due to differential cooling/heating and exacerbated by impurities in the stone itself and possible color and textural changes are 3rd level data [totally subjective at this point]).

Field #20 Completeness
(Column 48)

CODE

1 and 2

1 Complete (Somewhat subjective evaluation of whether [or not] an object is whole. Used to key on broken items for possible future breakage

2 Partial analysis).

3 Rejuvenated (A once-broken item showing signs of repair).

Field #21 Traditional Descriptors
(Columns 49, 50, 51)

CODE

001 - 999

001 Utilized Flake/Chunk
002 Unifacially Retouched Flake
003 Bifacially Retouched Flake
004 Resharpening Flake
005 Amorphously Flaked Object
006 Burin Spall
007 Biface
008 Projectile Point, Whole
009 Projectile Point, Base
010 Projectile Point, Tip
011 Blade
012 Microblade
013 Flake Off of Blade Core
014 Micro Blade Core
015 Drills
016 Graver
017 Burin
018 Scraper
019 Spokeshave
020 Core
021 Tabular Knives
022 Hammerstone
023 Maul
024 Pestle
025 Edge-Ground Cobble
026 Netsinker
027 Chopper
028 Peripherally Flaked Cobble
029 Amorphously Flaked Cobble
030 Millingstone-Flat or Ind.
031 Hopper Motar
032 Anvil Stone
033 Shaft Abrader
034 Bead
035 Pipe
036 Blades 10mm in Width
037 Blade Core 10mm in Width
038 Cascade Core
039 Cascade Flake
040 Cascade Blade

Appendix E

X-RAY FLUORESCENCE TRACE ELEMENT ANALYSIS
OF AN OBSIDIAN SAMPLE
FROM TWO SITES IN NORTH CENTRAL WASHINGTON

by

Robert Lee Sappington

RECEIVED

JUN 13 1983

CWAS

LETTER REPORT 83-10

University of Idaho
Laboratory of Anthropology
Moscow, Idaho 83843

7 July 1983

James C. Chatters
Assistant Director
Central Washington Archaeological Survey
Central Washington University
Ellensburg, WA 98926

Dear Jim:

X-RAY FLUORESCENCE TRACE ELEMENT ANALYSIS OF AN OBSIDIAN SAMPLE FROM TWO SITES IN NORTH CENTRAL WASHINGTON

Four obsidian flakes from two sites in north central Washington, 45-OK-208 and 45-OK-197, were analyzed by non-destructive energy dispersive x-ray fluorescence in order to determine their geological source areas. The system employed for this analysis was provided by the Idaho Bureau of Mines and Geology and consists of a Tracor Northern NS-880 instrument, a Nuclear Semiconductor 512 amplifier, a silicon (lithium-drifted) detector with a New England Nuclear americium 241 100 mCi source and a dysprosium secondary target, attached to a PDP 11/05 computer and a Decwriter II printer. All items were analyzed in air for a 300 second counting period and the intensities of ten trace elements (Table 1) were recorded. Four of these elements (Fe, Ns, La, and Ce) are unreliable for determining sources; the remaining six were employed as the variables for SPSS discriminant analysis using the Mahal stepwise method. Comparisons were made with 21 regional source groups located in central Oregon and south central Washington (Fig. 1).

All items were correlated to two sources in central Oregon (Table 2) with high probabilities. Artifacts from these sources have been identified at other sites across the Columbia Plateau and these results can be considered fairly "typical" for the region. Despite the difference in dates between the two sites, the co-occurrence of the Quartz Mt. source suggests continuity in obsidian procurement in the general study area across a span of several thousand years, although the small number of items included in the sample prevents over emphasis on this trend.

Sincerely yours,

Robert Lee Sappington
Research Associate

RLS:cll

Enclosures

TABLE 1

Trace element intensities for items in the sample

Item No.	Fe	Rb	Sr	Y	Zr	Nb	Sn	Ba	La	Ce
20S/17W	0128	0011	0000	0017	0000	0014	0043	00071	0000	0000
13S/31.75W	0124	0076	0000	0036	0040	0064	0000	00047	0000	0000
12S/31.75W	0049	0072	0000	0047	0044	0076	0066	00112	0000	0000
5.74S/29.52W	0173	0010	0000	0006	0014	0009	0022	00001	0001	0015

TABLE 2

Correlations of the obsidian items in the sample. Probability of the fit is in column P(G/X)

Item No.	Highest Probability Group	P(X/G)	P(G/X)	2nd Highest Group	P(G/X)	Discriminant Scores				
20S/17W	Quartz Mt.	0.0185	0.9312	Tucker Hill	0.0382	-1.4369 -0.3868	-2.3386	-6.7821	-1.123	-2.3929
13S/31.75W	Tucker Hill	0.0979	0.9415	Quartz Mt.	0.0585	-1.0975 -0.4692	-1.8928	-7.0445	-1.7847	-0.3225
12S/31.75W	Tucker Hill	0.0607	0.8655	Quartz Mt.	0.1344	-1.0311 -0.2907	-1.7416	-7.0718	-1.3821	-0.4519
5.74S/29.52W	Quartz Mt.	0.0224	0.9145	Tucker Hill	0.0516	-1.2631 -0.3843	-2.5456	-6.5762	-1.4885	-2.4319

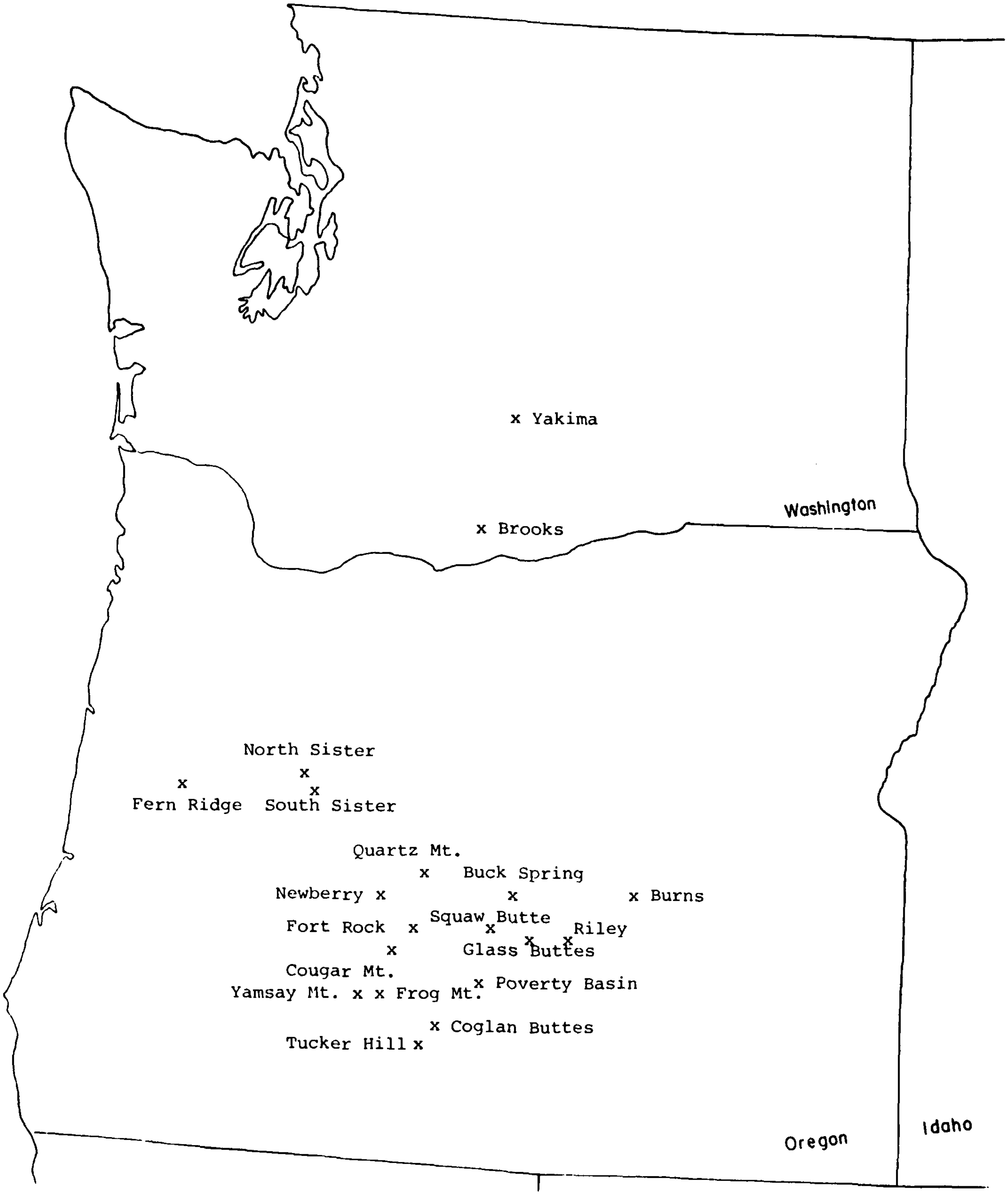

Figure 1. Location of sources used for comparison with the sample.

Appendix F

PLANT MACROFOSSIL IDENTIFICATIONS: ANALYSIS AND RESULTS

by

Lawrence Leney

UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

College of Forest Resources

1907 1982

RECEIVED
19
CWAS

April 13, 1983

Dr. James C. Chatters, Assistant Director
Central Washington Archaeological Survey
Central Washington University
Ellensburg, WA 98926

Dear Dr. Chatters:

This is to report on the identification of charcoal for 5 samples, collections from sites 45OK165, 45OK196 and 45OK207. A total of 71 pieces of charcoal were prepared and specially mounted so the different planes of direction (transverse, radial and tangential) could be examined with an incident light microscope. This required 97.75 hours. This averaged out to 1.4 hours per identification including preliminary examination for choice of pieces and all preparation.

The float sample as received by me was transferred to a petri dish for preliminary examination with a stereoscopic microscopic at 7 to 30x. If there was an apparent similarity of many pieces, the sampling was biased to include as many different type pieces as possible. When there was a random mix of material, charcoal pieces were chosen at random to include both larger and some small pieces.

Because of fine ash particles present, the charcoal had to be washed to remove most of such debri. This had to be done very carefully to prevent disintegration of the charcoal. Because break up of charcoal pieces might occur, larger ones were washed individually, so if they broke up, the smaller pieces could be mounted as coming from a single charcoal piece.

Where charcoal pieces were large enough they were subdivided to produce subpieces with the principal planes of section and these were mounted individually for greatest ease of examination. In some cases 4 to 8 subpieces were mounted for a single piece of charcoal. It was more economical of time to mount all at one time rather than have to redo it later.

Page two
Dr. James C. Chatters
April 13, 1983

Charcoal pieces were mounted on toothpicks using cellulose acetate adhesive. A special toothpick holder allowed the orientation of the piece for best examination.

A Zeiss EPI microscope was used for the microscopic study with incident light.

The woods which get to tree or commercial size were identified using the experience gained over a number of years. Such woods are well described in the literature. However for shrub or small woody plants there is a very limited amount of descriptive information available. The best reference for shrubs in the Northwest is: Dale, Arlene. 1968. Comparative Wood Anatomy of Some Shrubs Native to the Northern Rocky Mountains; Research paper INT-45; Intermountain Forest and Range Experiment Station, Ogden, Utah. However, it is rather inadequate for indentification purposes. The anatomical descriptions are very incomplete; omitting many anatomical features which might be useful when identifying charcoal. When identifying charcoal, particularly smaller pieces, it is not possible to see all the features one might find in a regular microscope slide. The more information one has about the wood anatomy of a species the more one can use those features which can be seen in the charcoal.

To continue in this investigation of charcoal of shrubs and small woody plants will require more time on original descriptive anatomy if greater accuracy is to be achieved. I visualize a descriptive work including both normal wood and charcoal. The charcoal part emphasizing the features visible in the charred wood some of which may not be visible or of quite different appearance in the uncharred wood.

Attached is a summary of the results of the identifications carried out to date.

Sincerely,

L Leney

Lawrence Leney
Professor
Wood Science Technology

lw

attachment

IDENTIFICATION OF CHARCOAL FROM FLOAT SAMPLES FOR CENTRAL WASHINGTON ARCHAEOLOGICAL SURVEY

by

Dr. Lawrence Leney

Site Designation	Number of Pieces Identified	Identification
450K 165	1	Ribes
Area B 30S-105W	1	Holodiscus
Level 120-140 cm	2	Total Hardwoods
	8	Conifers, all Pinus ponderosa or P. contorta
450K 165	8	Crataegus
Area 15 N-0 W	3	All same unknown hardwood
Feature 1	11	Total Hardwoods
Harth matrix		
Level 20-40 cm	4	Juniperous
Float sample #2	3	Pseudotsuga
	1	Abies
	2	Conifers, the same but unknown
	10	Total conifers
450K 207		
18 S-1 W	7	Alnus or Ledum
Bag 35, Float Sample #127	3	Salix
Field item #2	10	Total, only hardwoods
Location Q 5		
Depth 175 cm BUD description FLOT		Very small pieces and small amount
450K 207	16	Artemesia tridentata
Area A, 13S-1 W	2	not Artemesia, unknown
80-90 NW	18	Total hardwoods
Depth 85-90	1	Conifer: Pinus ponderosa or P. contorta
Loc H 5		
Bag 19, Field 3		
Float sample #170		
450K 196	8	All Conifers
Square 3		Juniperous or possibly
Level 100-120 cm		Thuja branch wood
Float Sample #74		

Site Designation	Number of Pieces identified	Identification
450K 197	3	*Tsuga heterophylla*
2.45 53.9 W	2	*Pinus ponderosa* or *P. contorta*
Historic Hearth	4	*Pseudotsuga*
Strata #1	1	*Larix*
Float Sample 105	10	Conifers
	3	Hardwoods, all salix

Appendix G

FULL FAUNAL DATA FROM RM 590 SITES

NONCIRCULATED: Not circulated, available on request from: Seattle District Corps of Engineers, P.O. Box C-3755, Seattle, WA 98124

Appendix I

PROJECTILE POINTS FROM RM 590
METRIC AND NONMETRIC DATA

by

Steven D. Lipsky

NONCIRCULATED: Not circulated, available on request from: Seattle District Corps of Engineers, P.O. Box C3755, Seattle, WA 98124.

END

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